Integrating Novel Digital Technology for the Testing & Treatment of Chlamydia into Mainstream Sexual Health Services in England

By

Susan Elizabeth Eaton

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Declaration and Inclusion of Material from a Prior Thesis

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy. It has been composed by myself and has not been submitted in any previous application for any degree.

The work presented (including data generated and data analysis) was carried out by the author except in the cases outlined below:

Not Applicable

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Abstract

Background

UK health policy places digital technology developments at the heart of plans to improve health, increase access and reduce cost. Electronic health (eHealth) and mobile health, offer opportunities to revolutionise the way services for sexually transmitted infections (STIs) are delivered. Developments include point-of-care and self-tests, and online treatment through eHealth clinics. Such innovations offer potential benefits including increased testing uptake, higher treatment rates and reduced disease transmission.

This thesis explored the impact of the adoption of remote self-testing and an eHealth clinic (for remote treatment and contact tracing) into pathways for the management of asymptomatic genital *Chlamydia Trachomatis.*

Research Outputs

Young people's preferences: A discrete choice experiment (DCE) that quantified which factors are important to 1,230 young people in chlamydia testing and treatment pathways. This mixed-methods approach included:

- Literature reviews to inform the 'long list' of potential attributes
- Focus groups with young people aged 16-24 to elicit views on attributes which are important in STI services
- Expert groups to provide a policy/ service perspective
- Cognitive testing to inform the development of the DCE questionnaire
- National DCE of 16-24 year olds using online research panel.

Technology costs and benefits: An early economic evaluation to assess the costs and benefits of introducing an eHealth clinic for chlamydia treatment, and extended to explore the considerations for a fully remote self-testing and treatment pathway. This has been informed by two literature reviews exploring costs and consequences and a primary costing study.

Results

The DCE found that test accuracy, followed by time to result were the strongest attributes influencing preferences.

The economic evaluation identified that online care is cost saving compared with existing practice however further work is required to understand the impact on health outcomes.

The thesis findings should help inform adoption of new technologies into mainstream chlamydia testing and treatment pathways.

Abbreviations

3G	Third Generation
4G	Fourth Generation
app	Smartphone Application
APT	Accelerated Partner Therapy
BASHH	British Association for Sexual Health and HIV
BSREC	Biomedical and Scientific Research Ethics Committee
CADTH	Canadian Agency for Drugs and Therapeutics in Health
CaSH	Contraceptive and Sexual Health Services
CASI	Computer Aided Self Interview
CBA	Cost Benefit Analysis
CCA	Cost Consequence Analysis
CCG	NHS Clinical Commissioning Group
CEA	Cost Effectiveness Analysis
CfH	Connecting for Health
CHEERS	Consolidated Health Economic Evaluation Reporting Standards
CI	Confidence Interval
ClaSS	Chlamydia Screening Studies
CMA	Cost Minimisation Analysis
CQUINs	Commissioning for Quality and Innovation Schemes
CSO	Chlamydia Screening Office
CT	Chlamydia Trachomatis
CUA	Cost Utility Analysis
DAP	Diagnostics Assessment Programme
DCE	Discrete Choice Experiment
DH	Department of Health
ECDC	European Centre for Disease Prevention and Control
eHealth	Electronic Health
eHTA	Early Health Technology Assessment
EIA	Enzyme Immunoassay
ELISA	Enzyme Linked Immunosorbent Assay
EPS	Electronic Prescribing Service
EPT	Expedited Partner Therapy
eSTI^2	Electronic Self-Testing Instruments for Sexually Transmitted Infections
EU	European Union
EVPI	Expected Value of Perfect Information
FDA	Food & Drug Administration
FFD	Full Factorial Design
FrFD	Fractional Factorial Design
GPRS	General Packet Radio Service
GUM	Genito-Urinary Medicine
HCHS	Hospital and Community Health Services
HCP	Health Care Professional
HST	Highly Specialised Technology
HTA	Health Technology Assessment
ICER	Incremental Cost-Effectiveness Ratio
IIA	Independence from Irrelevant Alternatives
IM	Instant Messaging

IP	Interventional Procedures [Programme]
ISPOR	International Society for Pharmacoeconomics and Outcomes Research
IVD	In Vitro Diagnostic
LA	Local Authority
mHealth	Mobile Health
MHRA	Medicines & Healthcare Regulatory Agency
MNL	Multinomial Logit Model
MOA	Major Outcome Averted
MRC	Medical Research Council
MTEP	Medical Technologies Evaluation Programme
NAAT	Nucleic Acid Amplification Test
NATSAL	National Survey of Sexual Attitudes and Lifestyle
NG	Neisseria Gonorrhoeae
NCSP	National Chlamydia Screening Programme
NHS	National Health Service
NHSE	NHS England
NIB	National Information Board
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health Research
NPfIT	National Programme for Information Technology
OCCP	Online Chlamydia Care Pathway
OFCOM	Office of Communications
ONS	Office for National Statistics
OR	Odds Ratio
PbR	Payment by Results
PCT	Primary Care Trust
PGD	Patient Group Directions
PHE	Public Health England
PHOF	Public Health Outcomes Framework
PID	Pelvic Inflammatory Disease
PMCF	Prime Minister's Challenge Fund
PN	Partner Notification
POC	Point of Care
POCT	Point of Care Test
PPV	Positive Predictive Value
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
PROM	Pre-Term Rupture of Membranes
QALY	Quality Adjusted Life Year
QIPP	Quality, Innovation, Productivity and Prevention
RCT	Randomised Control Trial
RSE	Relationships & Sex Education
SASH	Studies in Adolescent Sexual Health Group
SMS	Short Message Service
SOP	Standard Operating Procedure
STI	Sexually Transmitted Infection
TA	Technology Appraisal
WHO	World Health Organisation
WSD	Whole Systems Demonstrator

Glossary of Terms

Term	Definition within Thesis
Asymptomatic	Individuals testing for chlamydia who have no symptoms.
eSTI^2	The research consortium which is developing self-testing and eHealth solutions for STI testing and treatment. Further information about the consortium is included in Appendix 1.
False Negative (FN)	A test result which incorrectly identifies the individual as being disease free when they have the disease.
False Positive (FP)	A test result which incorrectly identifies the individual as having the disease when they are disease free.
Fully Remote Online Pathway	The conceptual full pathway for chlamydia which includes a self-test which interfaces with the online chlamydia care pathway (OCCP).
Negative Predictive Value (NPV)	The percentage of negative results that are true negative results.
Online Chlamydia Care Pathway (OCCP)	A product developed by the eSTI^2 research consortium. It commences at results notification and concludes at partner notification. This technology was tested in an exploratory pilot study and data collected within the study is used to inform the costing study in this thesis. The OCCP is an eHealth clinic which is optimized for use on a mobile phone internet browser.
Positive Predictive Value (PPV)	The percentage of positive results that are true positive results.
Remote Care Pathway	Non-face-to-face pathways where patients are not required to attend a healthcare setting for diagnosis or treatment. This can include services delivered online, via telephone, video-conferencing, instant messaging etc.
Screening	Testing of individuals who are asymptomatic. The term is used both within the context of the National Chlamydia Screening Programme (NCSP) and asymptomatic individuals attending health care settings for testing regardless of whether they fit within the definition of the NCSP.
Self-Sampling	The process by which the individual takes their own sample. The sample is processed by a laboratory and results interpreted by a healthcare professional.
Self-Test	A test where the sample is taken and the result is interpreted by the user. Whilst work has been undertaken to develop a test as part of the eSTI^2 research programme, no self-test product is currently available which meets the standards for use within the NHS.
Symptomatic	Individuals testing for chlamydia who have symptoms of an infection (which may or may not be chlamydia).
True Negative (TN)	A test result which correctly identifies the individual as being disease free.
True Positive (TP)	A test result which correctly identifies the individual as having the disease.

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CHAPTER 1 – INTRODUCTION

"One of the greatest opportunities of the 21st century is the potential to safely harness the power of the technology revolution, which has transformed our society, to meet the challenges of improving health and providing better, safer, sustainable care for all".
(National Information Board, 2014:6).

The World Health Organisation (WHO) identify that the population at risk of sexually transmitted infections (STIs) will continue to grow considerably as a result of "social, demographic and migratory trends" (WHO, 2007:3), and that whilst the developing world is subject to the greatest burden of disease, STIs and their associated complications will remain a significant public health problem for all countries (WHO, 2013).

Chlamydia is the most commonly diagnosed sexually transmitted infection (STI) in England, the European Union (EU) and the USA, with rates of reported diagnoses continuing to increase (ECDC, 2014). In England young people aged 15-24 account for 61% of chlamydia cases (Public Health England, 2016b). Whilst easy to treat with a single dose antibiotic, it is largely asymptomatic and can result in serious long term consequences for women in particular, including pelvic inflammatory disease (PID), ectopic pregnancy and infertility (WHO, 2012). The resultant complications present a significant economic burden to health services and the wider economy compared with the costs of screening for the disease (ECDC, 2014). Despite the introduction of the National Chlamydia Screening Programme (NCSP) in England in 2003 for 16-24 year olds, uptake of opportunistic screening for chlamydia remains low.

Advancements in technology, particularly electronic health (eHealth) and mobile health (mHealth), have already opened up a wide range of options to revolutionise the way that aspects of STI testing and treatment services are delivered. These include the development of point-of-care (POC) and self-tests, and online treatment pathways either through eHealth clinics or smartphone applications (apps). Such innovations may offer a number of potential benefits for service delivery including increased testing uptake, higher treatment rates and reduced disease transmission.

This thesis presents the doctoral research undertaken to inform the understanding of young people's preferences for new STI testing and treatment services and the costs and consequences of the introduction of self-tests and eHealth clinics, with a specific focus on services for the testing and treatment of chlamydia.

1.1 Setting the Scene

Chlamydia Trachomatis is the most commonly diagnosed STI in England (PHE, 2016a). Whilst genital chlamydia trachomatis is the most frequently diagnosed, pharyngeal and rectal infections also occur. For the purposes of this thesis, chlamydia and chlamdial infection refer to genital chlamydia trachomatis only. Within mainstream sexual health services in England over 434,000 new diagnoses of STIs were made in 2015, 46% (200,288) of these were chlamydia (Public Health England, 2016b). Young people aged 15-24 experience the highest rates of STI diagnosis with 61% of all chlamydia diagnoses made in 2015 in this age range (ibid.). STI diagnoses within this age range have risen consistently for the last five years, although recently, the number of chlamydia diagnoses has decreased slightly (ibid.).

The recommendation of NCSP is that sexually active young people should be screened for chlamydia annually, on change of partner or three months after a positive test result (ibid). Data for 2015 indicate that, based on an assumption of one test per person, 32% of females and 13% of males within the target age range were tested for chlamydia (ibid.). The Public Health Outcomes Framework (PHOF) for England has a specific target for Chlamydia diagnosis within the central objective to protect population health, with a target detection rate of 2,300 per 100,000 population within the 15-24 age range (Department of Health, 2013c). In 2015 only 20% of upper tier local authorities (LA) achieved this target (Public Health England, 2016b). Data demonstrates a strong correlation between testing coverage and chlamydia detection rates (ibid.).

Estimates of the cost of treatment and economic burden associated with chlamydia are limited. The most recent work by Development Economics refreshes the approach taken by the North West Public Health Observatory in 2005. This reflects 2011 data and estimates the direct medical costs per identified case of chlamydia to be £796.87 (£176.86 million annualised amount) (Development Economics, 2013). Detailed scenario estimation was included in their report, which demonstrated that if growth in detection rate continued at 2002-2011 levels and access to services continued on the same basis, the annual direct medical cost for the treatment of chlamydia in 2015 would be £249.8 million and 2020 would be £387.4 million (ibid.).

As outlined briefly above, new digital technologies may have the potential to increase testing coverage and treatment rates and therefore reduce disease transmission particularly within the 16-24 age range. Data on internet usage published by the Office for National Statistics (ONS) supports this, demonstrating high levels of accessibility to the required base technology:

- Internet access is now available in 89% of households with 99% of households with children having an internet connection,
- 75% of the adult population now report accessing the internet via a mobile device such as a smartphone or tablet, however this percentage is much higher in the 16-24 age range at 97%,
- 82% of the adult population now access the internet daily (Office for National Statistics, 2016b).

Advancements in technology including fibre optic broadband, fourth generation (4G) mobile networks and public Wi-Fi hotspots are improving speed of access to internet content. However, despite the growth in internet use for many activities of daily life such as banking and food shopping, this pace of adoption has not been realised in the delivery of healthcare services: "the consumer experience of care services remains much as it was before the mobile phone and internet became commonplace" (National Information Board, 2014:8).

1.2 The Research Problem

Low uptake of chlamydia testing services as outlined previously represents both an individual and population health problem. As well as the financial costs of diagnosing and treating chlamydial infection, there are also the economic consequences of untreated infection, including further transmission.

Research suggests that there are many factors which prevent young people accessing sexual health services, including chlamydia testing. These can include tangible service properties such as location of service, and personal factors including the stigma associated with attendance, embarrassment and fear of being recognised or privacy concerns (Booth et al., 2013, Friedman and Bloodgood, 2013, Balfe and Brugha, 2009). The findings of previous studies are discussed further in Chapter 4.

Within the context of service delivery, sexual health services are one of the only open access diagnostic services available within the National Health Service (NHS), that is, the individual can initiate the test without a referral from a healthcare professional. There is a key question as to the role of new technology in the delivery of sexual health services, particularly in the use of remote care pathways[1] which both the development of self-tests and eHealth/mHealth solutions form part of - will they increase uptake of testing and treatment by young people for chlamydia infections and are they a cost-effective way of delivering a health service? There are currently no published studies that explore young people's preferences for the use of a remote clinical pathway involving self-testing and online clinical management for the testing and treatment of chlamydia, or whether this is a cost-effective service delivery model.

Whilst there are examples of smartphone diagnostics and apps being marketed to consumers, adoption of similar technologies by the NHS in 2016 is low. At the time of writing this thesis there are no smartphone diagnostic apps made available by the NHS for patients to use and the NHS apps library has been withdrawn, removing access to the limited number available which focused on health information and symptom recording (NHS England, 2015).

[1] Remote care pathways can be defined as non face-to-face pathways where patients are not required to attend a healthcare setting for diagnosis or treatment. This can include services delivered online, via telephone, instant messaging or videoconferencing.

1.3 Aims of Research

The aim of this research was to explore the costs and benefits of integrated online chlamydia testing and treatment within an early health technology assessment (eHTA) framework. The research undertaken had the following objectives:

- ***To assess which attributes influence young people's preferences for the testing and treatment of chlamydia and to explore their implications for the development of sexual health services in England***
- ***To explore the likely costs of implementing online chlamydia treatment in mainstream sexual health services in England***
- ***To develop an economic model to assess the likely costs and benefits of implementing a fully remote, integrated online pathway including self-testing.***

Consideration is given to the limitations of the work and its implications for the commissioning and delivery of sexual health services within England, as well as areas for further research.

Figure 1.1 provides an overview of the conceptual elements of a fully remote chlamydia self-testing and treatment pathway, and figure 1.2 illustrates a fully integrated remote pathway flow chart.

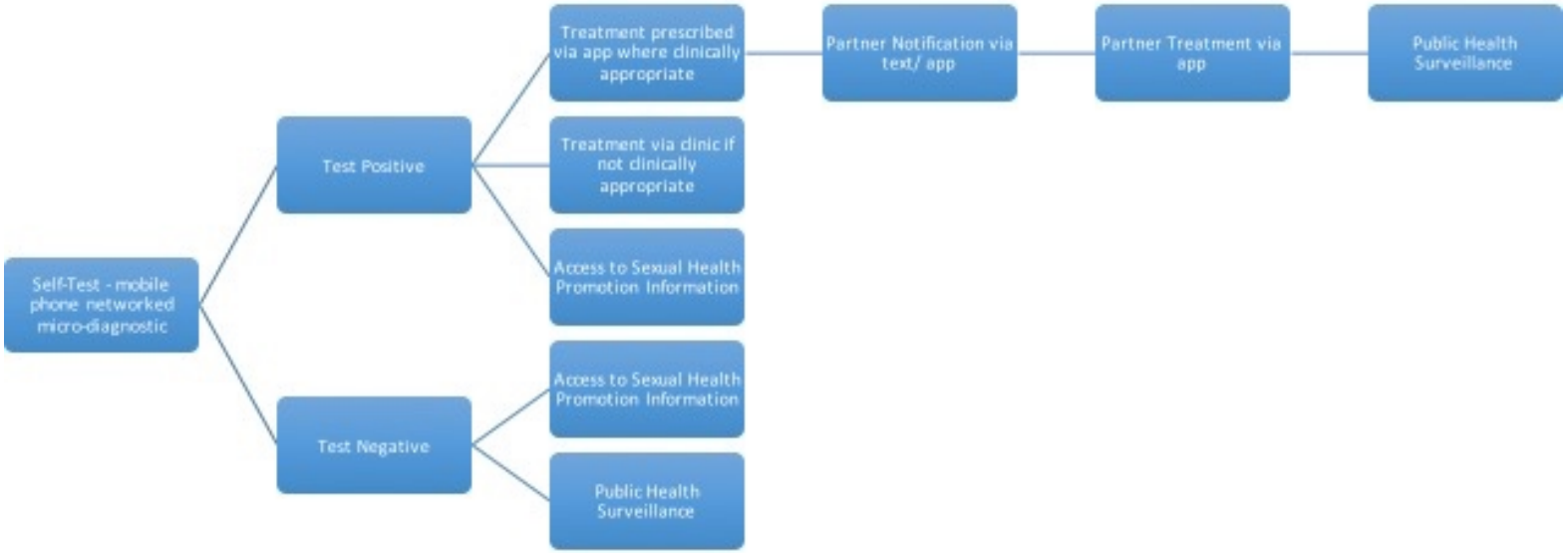

Figure 1.1 - Components of a Fully Integrated Remote Pathway for the Testing & Treatment of Chlamydia

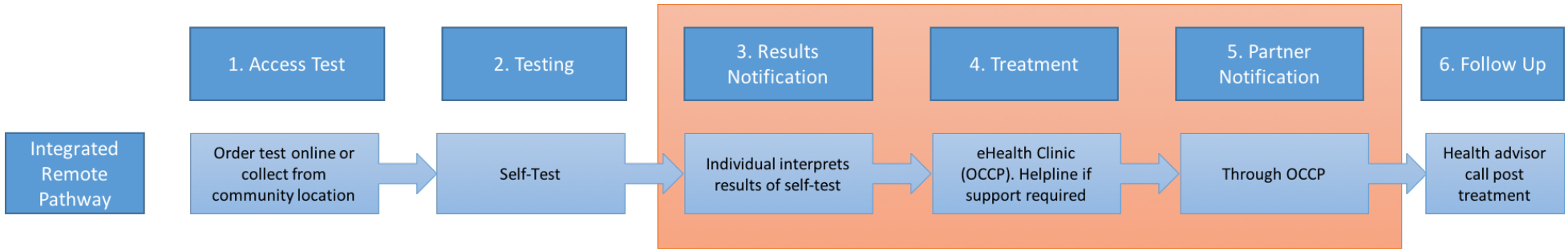

Figure 1.2 – Fully Integrated Remote Pathway Flow Chart

There are two separate technologies within the fully integrated pathway which are at different stages of development – the online chlamydia care pathway (OCCP) and the self-test. The key terms in relation to the technologies and the pathway which are used throughout the thesis are defined in glossary of terms on page 13.

1.4 Overview of Thesis Structure

The following chapter (Chapter 2) provides more detailed background to a number of the key issues introduced in section 1.1. Chapter 3 outlines the theoretical framework for Health Technology Assessment (HTA) and eHTA, considering the current stage of technology development. It also presents the methods selected to address the research objectives and summarises the scope of research undertaken as part of this doctoral research.

Chapter 4 presents current research evidence on individuals' preferences for accessing testing and treatment services for STIs, including the service attributes which might influence preferences. Chapter 5 presents the findings of qualitative research including focus groups and expert groups undertaken to develop the main themes and, from them, identify the attributes and levels for inclusion in the Discrete Choice Experiment (DCE). This leads into Chapter 6 which describes the experimental design, results, analysis and conclusions of the DCE.

Chapter 7 explores the costs associated with the OCCP exploratory study and presents the outcome of the costing study including a cost analysis of the OCCP and review of intermediate outcomes. Chapter 8 builds on this, extending the work into an economic model to explore the impact of both the OCCP and a fully integrated remote pathway.

Chapter 9 reflects on the findings of this research more generally and their implication for sexual health services, drawing out the key conclusions and recommendations for further research.

CHAPTER 2 – BACKGROUND TO THE RESEARCH

2.1 Introduction

The purpose of this chapter is to frame the context for the research presented in subsequent chapters. It provides evidence on the current position in respect of policy, definitions and key data that run throughout the chapters in this thesis.

An analysis of the evolution of eHealth and mHealth is given, set within the framework of policy and practice of healthcare in England and learning from international developments. Next, a review of key aspects of sexual health services in England is presented, including both the general policy position for sexual health services, with a specific focus on chlamydia where appropriate, drawing out current practice and an overview of the implementation of eHealth and mHealth.

2.2 History of Digital Technology

From the initial creation of the concept of the world wide web in 1989 to an estimated 3.2 billion users world-wide in 2015 (BBC, 2015), the internet creates opportunities for open access to information and services in ways that were previously unfeasible, through other communications media. The transition to digital mobile networks in the early 1990s, enabled an expansion of service providers and growth in the phone development market as well as the introduction of mobile data services in 1999 (OFCOM, 2012).

The transition through mobile network types from general packet radio service (GPRS), to third generation (3G) and 4G networks over the last 10 years, coupled with the significant growth in smartphones since the launch of the iPhone in 2007, has led to an explosion in the growth of mobile phone use for data services such as email and internet services (Fiordelli et al., 2013). A further addition to smartphone services is the 'app' – software designed specifically to run on a device such as a mobile phone. Estimates in June 2016 suggest that 1.5 million apps are available in the Apple app store and since its launch in 2008 130 billion downloads have been made (Statistica, 2016a). Whilst Apple led the field, apps are now available on other smartphone operating systems. Google Play, which is the leading app store for android (an alternative operating system to Apple's) devices, has 2 million apps available in its store (Statistica, 2016b).

To set the context of digital technology access in the UK, building on the data introduced in Chapter 1, data from the Office of Communications (OFCOM) which regulates the communications market in the UK, identified that at the end of 2015 there were 91.5 million active mobile phone subscriptions (OFCOM, 2016). The quarterly 'Technology Tracker' trends survey published by Ipsos Mori identified that in quarter 2 of 2016:

- internet access across gender and socioeconomic status for 15-24 year olds is consistently high, with the lowest access rate in females aged 15-24, socioeconomic status D and E at 96%
- smartphone ownership across gender and socioeconomic status is also high with 94% of males and 95% of females aged 15-24 owning a smartphone. The lowest rates of ownership within this age group are males, socioeconomic status D&E (91%) (Ipsos Mori, 2016).

Disparities in overall mobile internet usage and smartphone ownership present an important consideration in the development of mHealth interventions. Whilst apps have the benefit of being able to utilise features of the phone such as the camera (a potential option for the analysis of test results), websites optimised for use on a mobile phone are accessible by all operating platforms therefore extending the user base (We are Apps, 2013).

The ONS data for the UK published for 2016 shows an increase in the reported use of the internet to find health information from 18% in 2007 to 51% in 2016 (Office for National Statistics, 2016b). There are a number of published studies which demonstrate a preference among patients and citizens for the use of the internet to source information about health conditions. A literature review published in 2011 by the European Centre for Disease Prevention and Control (ECDC) found that use for this purpose was growing rapidly amongst patients, carers, and their friends and relatives, with women and those more highly educated more likely to search for health information online (Higgins et al., 2011).

2.3 Digital Health

This section considers the key concepts and definitions used in this thesis in greater depth. It is recognised that due to the relative newness of the digital field there is an absence of *"commonly accepted or industry wide meaning"* (Wragge & Co and ECH Alliance, 2014:7) as well as no definition within UK or EU law (ibid.).

There are many terms used to describe the use of digital technology within the delivery of healthcare. The common overarching term in use in most current policy documents is 'digital health', although no consistent definition is offered within these. One definition, offered by Kostkova is *"the use of information and communications technologies to improve human health, healthcare services, and wellness for individuals and across populations"* (Kostkova, 2015:1). Many other terms are also in use, such as telemedicine, telehealth, telecare, connected health, eHealth and mHealth.

The WHO offers a definition of telemedicine as *"the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities"* (WHO, 2010:9).

It is recognised that there are similarities in the use of the terms telemedicine and telehealth, with van Dyk noting that delivery over a distance is a common feature of both telemedicine and telehealth (van Dyk, 2014), and Bashshur and colleagues suggested that *"conceptually, telemedicine is to telehealth what medicine is to health"* (Bashshur et al., 2011:487). A white paper by Wragge and Co draws out a key distinction in the use of the terms suggesting that telemedicine is used to describe "*the provision of a regulated healthcare service"* (Wragge & Co and ECH Alliance, 2014:10) whilst telehealth refers to the remote monitoring of physiological data. This contrasts with telecare that focuses on monitoring of the individual living in their own home.

The definition of telecare offered by the Telecare Services Association is *"support and assistance provided at a distance using information and communication technology. It is the continuous, automatic and remote monitoring of users by means of sensors to enable them to continue living in their own home, while minimising risks…"* (Telecare Services Association, 2015).

Deloitte UK offer a definition of connected health as *"connected health or technology enabled care (TEC) is the collective term for telecare, telehealth, telemedicine, mHealth, digital health and eHealth services. TEC involves the convergence of health technology, digital, media and mobile telecommunications and is increasingly seen as an integral part of the solution to many of the challenges facing the health, social care and wellness sectors, especially in enabling more effective integration of care"* (Deloitte Centre for Health Solutions, 2015:1).

The terms eHealth and mHealth have been more recently introduced with eHealth first being discussed in the late 1990s and mHealth becoming more established following the new generation of smartphone and tablet technology which became mainstream in the mid 2000s. A summary of the key features and types of technology is presented in table 2.1.

	Telemedicine	eHealth	mHealth
Key Features	Linked directly to clinical service delivery	Broad scope including other non-clinical IT solutions within health	Subset of eHealth involving use of mobile devices such as phones or tablets
Examples	• Virtual Clinics • Remote monitoring	• Electronic Health Records • ePrescribing • eCommerce within health • Health information • Delivery of web-based services/ interventions	• SMS Appointment Reminders • Apps – health information, public health interventions, monitoring • Remote monitoring • Diagnostics

Table 2.1 - Features of Telemedicine, eHealth & mHealth

The founding definition of eHealth was proposed by Eysenbach as "*an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude and a commitment for networked, global thinking, to improve healthcare locally, regionally, and worldwide by using information and communication technology"* (Eysenbach, 2001:e20).

In undertaking its second global survey on eHealth the World Health Organisation (WHO) recognised the absence of a standardised definition of mHealth, choosing to define it as *"Medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and other wireless devices"* (WHO, 2011a:2). A more concise definition offered by Free and colleagues is *"the use of mobile computing and communication technologies in healthcare and public health"* (Free et al., 2013b).

MHealth is closely aligned with other health technologies, particularly eHealth and telemedicine with the mobile device enabling existing technologies to be utilised in a different way, e.g. remote monitoring, as well as extending the scope of technology available for use, as illustrated in table 2.1. The pace of change in the development of mobile technologies has presented significant opportunities for the growth of mHealth initiatives, making the categories considered by the WHO survey in 2009 seem almost obsolete.

2.3.1 Digital Health Policy in the NHS in England

NHS health policy has incorporated these technological advances. The publication in 1998 of 'Information for Health – An Information Strategy for the Modern NHS 1998-2005' set out a commitment from the Department of Health to delivering, amongst other things "lifelong electronic health records for every person in the country…fast and convenient public access to information and care through on-line information services and telemedicine" (Department of Health, 1998:9).

Much of the early digital health policy in the NHS was centred on addressing the IT infrastructure and system deficits within hospitals and primary care. The NHS Plan was the first major general policy document to acknowledge the need for modern IT systems in both general practice and hospitals (Department of Health, 2000). The plan included reference to a vision where self-care and self-management would be facilitated through the NHS Direct telephone and internet site, and information technology would be used to enable patients to email or phone GPs and practice nurses for advice and support for self-management, and to receive their test results at home. Digital television was also envisaged as a key enabler in the delivery of self-care (ibid).

From a policy perspective, over the period 2000-2010, the focus remained on the integration of systems through the work of Connecting for Health (CfH) in delivering the National Programme for IT (NPfIT). This included the development and implementation of systems linking both primary and secondary care including the NHS Care Records Service, Choose and Book and the Electronic Prescribing Services (EPS) (National Audit Office, 2006, National Audit Office, 2008, National Audit Office, 2011).

The publication of 'Innovation, Health and Wealth' in 2011 led to a notable policy shift away from a focus on IT systems for the NHS to the adoption of innovations which could impact directly on the provision of patient care. The 'digital by default' initiative was first introduced in this policy document and reinforced the vision in the original NHS Plan (2000) that "for many people who use electronic media as part of their daily lives, the ability to use email for non-confidential communications, or to have a remote consultation using telephone or online technology would offer a much more convenient way of accessing NHS services. The NHS can do more to drive down the level of inappropriate and unnecessary face-to-face contacts" (Department of Health, 2011:27).

The shift away from IT systems was reinforced by the publication of 'Digital First' in 2012 which aimed to "make available the digital means (channels, content, services) for the general public to manage their healthcare digitally wherever possible and provide the mechanisms and support that ensure they can migrate to these digital channels as their preferred manner to engage" (Department of Health, 2012:3). Ten high impact digital initiatives were cited which incorporated the use of eHealth and mHealth solutions, including using online and telephone triage, online/ remote consultation and short message service (SMS) reminders to deliver an estimated £3bn in savings for the NHS (ibid.).

During this period, digital health initiatives also began to spread into service and condition specific policies, including sexual health, to be outlined further in section 2.4.1. These were incorporated into healthcare contracting arrangements through service specifications, enhanced services and commissioning for quality and innovation schemes (CQUINs). The NHS five year forward view, published by NHS England in 2014, also gave a commitment to expanding the use of digital technology in the NHS recognising the role of a range of eHealth and mHealth solutions including health apps, online GP appointments and patients having full access to their electronic health record (NHS England, 2014). The subsequent National Information Board (NIB) report published later that year built on this commitment outlining the practical arrangements for taking forward this programme of work (National Information Board, 2014).

2.3.2 NHS Adoption of Telemedicine, eHealth and mHealth in England

The adoption of telemedicine, eHealth and mHealth at a system level within the NHS and other health systems has proved to be a challenge with limited evaluation of cost-effectiveness. A 2011 WHO global survey was the first to comprehensively identify barriers to adoption of mHealth by health systems internationally. Competing priorities within the health system were identified as the most significant barrier to the adoption of mHealth (52%), with lack of knowledge about how mHealth can be utilised and its contribution to health outcomes, lack of policy on mHealth initiatives at a national level, and poor data on cost-effectiveness of mHealth interventions being the most commonly cited reasons for not pursuing mHealth interventions (WHO, 2011a).

In England, with the exception of a few major initiatives that have been adopted fairly consistently across the NHS, for example text message appointment reminders, the adoption of eHealth and mHealth has followed a path of small scale, localised, initiatives with minimal structured evaluation, this is not dissimilar to that of other nations (ibid.). Sustained adoption has been heavily influenced by clinicians with for example, access to choose and book, the system for booking online hospital appointments, reducing when the financial incentive for GP practice participation ceased. The Whole System Demonstrator (WSD) project was the largest randomised control trial (RCT) undertaken in England designed to explore the costs and benefits of using telehealth and telecare alongside the standard interventions. The trial covered patients in three areas with one or more of the following conditions – chronic obstructive pulmonary disease, heart failure or diabetes, and considered the effect of telehealth on access to primary, secondary and social care services. The cost effectiveness analysis identified that telehealth was unlikely to be cost-effective where it was provided as an addition to standard care (Henderson et al., 2013).

Evidence on the adoption of eHealth and mHealth within the NHS for the diagnosis, treatment and management of long-term medical conditions indicates that widespread adoption is minimal. The NIB report published in 2014 acknowledged that, despite commitments given over the previous years in national policy, from a patient perspective "the consumer experience of care services remains much as it was before the mobile phone and the internet became commonplace. For care professionals, from social workers to doctors and nurses, the arrival of the digital age has often been experienced not as a force for good but rather as an intrusive additional burden in an already pressured existence" (National Information Board, 2014:8).

An internet search was undertaken to identify examples of eHealth and mHealth adoption within the NHS by searching for online NHS clinics. This returned a high proportion of results in the top 100 relating to either general practice, mental health or sexual health. In general practice, since 2013, there are increasing examples of the use of e-consultation, in part driven by opportunities through initiatives such as the Prime Minister's Challenge Fund (PMCF). An evaluation of the use of e-consultation in primary care found that 60% of e-consultations were closed remotely, 80% of e-consultations that required a call back were closed remotely and 18% of users who had planned to book a face-to-face appointment did not require one (The Hurley Group, 2014). A second area where an online service presence has been adopted is mental health services, with services such as Big White Wall leading the way with online therapy appointments delivered by instant message, video or audio services (Big White Wall, 2016). Examples of the adoption of eHealth and mHealth within sexual health services are presented in section 2.4.6.

In order to influence the adoption of health apps, in 2013, the NHS launched its apps library, incorporating a range of approved apps which had been evaluated and endorsed by the NHS (NHS England, 2015). Little information was available on the accreditation process, and there was no indication that apps had been assessed for cost-effectiveness. The library was widely criticised with significant concerns raised regarding data privacy; 89% of apps that sent data to online services and 66% of apps that sent personal information were found not to use encryption and no apps encrypted information stored on the device (Huckvale et al., 2015). The NHS apps library was removed in 2015 in order to enable the apps to be reviewed against an as yet unpublished set of criteria (NHS England, 2015).

2.3.3 eHealth and mHealth Products

There is considerable evidence in grey literature of a growing eHealth/ mHealth market, that is products and/or services targeted directly to the patient or general public, or products in an early stage of development which are not at the clinical trial stage. A grey literature search using Google was undertaken following the principles outlined in the Canadian Agency for Drugs and Technologies in Health (CADTH) checklist for grey literature (CADTH, 2013). This approach was selected to focus on trade and technology websites as the pace of technology development far outstrips the time lag for publishing journal articles. The objective of the search was to identify eHealth and mHealth products for diagnosis, monitoring and treatment, specifically to determine what technologies are under development and whether these are aimed at the healthcare provider market or the general public.

The search terms used were:

- health apps
- smartphone diagnostics healthcare
- online clinics healthcare.

The search terms were selected to reflect the topics of interest and to minimise overlap in search results. The searches were undertaken on 14 February 2016. The top 100 results returned were reviewed to identify their content, as recommended by CADTH (2013) and are summarised into themes as follows:

- health apps – links to app stores, news articles from mainstream news websites, blogs and news articles on trade websites, app review websites (reviews by users), government and health service websites principally promoting the use of health apps from the UK, USA and Australasia,

- smartphone diagnostics healthcare – blogs and mainstream news articles on smartphone diagnostics for health, press releases and websites for companies and research organisations developing smartphone diagnostics,
- online clinics health – private providers of online clinics in the UK and USA, NHS service websites offering online clinic booking, news articles about online health clinics from UK and USA.

The top 100 results from the smartphone diagnostics healthcare Google search (excluding blogs and other commentaries) identified the following diagnostics in varying stages of development:

- Colorimetrix – app developed by Cambridge University to read colorimetric tests including a capability to diagnose HIV, tuberculosis and malaria, and to monitor diabetes and kidney disease (University of Cambridge, 2014)
- Peek Vision – a device which sits over a smartphone camera and enables the diagnosis of eye conditions including glaucoma, macular degeneration and diabetic retinopathy (Peek Vision, 2015)
- QPoC – point of care platform which can analyse DNA in under 15 minutes. Whilst the device does not link to a smartphone it does enable remote point of care testing for infectious diseases, cancer and pharmacogenetics (Quantum MDx, 2015)
- ELISA Platform – platform which links to a smartphone which can interpret Enzyme Linked Immunosorbent Assays (ELISA) including HIV, West Nile virus and hepatitis B (UCLA, 2015)
- Smartphone dongle for interpreting ELISA results for infectious diseases (Medical Express, 2015)

- OJ-Bio Xtalline handheld diagnostic device – interfaces with a smartphone for the detection of protein biomarkers (News Medical, 2015)
- Smartphone based diagnostic for preeclampsia – journal abstract summarising the effectiveness of an app for using the Congo Red Dot test to diagnose preeclampsia (Jonas et al., 2015)
- MobiUS Scanner – ultrasound scanner that plugs into a smartphone to enable phone to be used as an ultrasound device (MobiSante, 2015).

The technologies identified are at varying stages of development and none of the sites reviewed referenced use within the NHS. The products appear to be targeted towards either developing countries or the US market.

Considering patients as consumers, there are a large number of health and wellness apps available in the Apple and Google Play App Stores. Xu and Liu created a central health related app repository in 2015 using apps from the Apple App store and Google Play store in the USA, China, Japan, Brazil and Russia and systematically analysed them to evaluate their strengths and weaknesses (Xu and Liu, 2015). Despite estimates being as high as 100,000 medical and fitness apps, their analysis concluded that there are only 21,121 unique (not duplicated) medical apps in the Apple App store and 5,378 medical apps in the Google Play App store in the US (ibid.).

In addition to apps, there are a number of smartphone 'add-ons' – wearables such as watches, and connected devices such as blood pressure monitors that increase the 'medical functionality' of the smartphone. These have primarily been targeted at individual consumers rather than featuring as a part of health services.

However, looking to the American healthcare system, Price Waterhouse Coopers (PWC) have predicted 2016 will see a growth in the use of such devices. “Connected otoscopes, activity trackers, scales, health apps, algorithm-based symptom checkers and on-demand e-visits are being offered directly to consumers. Clinicians are sending patients with chronic conditions home with connected pacemakers, ECG monitors, glucose trackers and other remote monitoring devices.” (Price Waterhouse Coopers, 2015).

The impact of this type of technology adoption was in part measured through the WSD RCT in England, however as the trial commenced in 2008, much of the technology piloted has been superseded. Of the smartphone-based diagnostics and eHealth solutions reviewed, so far none has attempted to integrate diagnosis and treatment for infectious diseases. In addition, no apps have been identified that prescribe a prescription only medicine without the input of a clinician. There are a number of websites that enable access to prescribed medicine without a face-to-face consultation for example Dr Thom however, every individual submission is reviewed by a GP prior to a prescription being issued (Lloyds Pharmacy, 2016).

2.4 Sexual Health Context

Alongside the changing digital context there have been several changes in the organisation and delivery of sexual health services in England. The following sections introduce the policy and commissioning context for sexual health services, and the epidemiology, clinical management and pathways for the testing and treatment of chlamydia, the disease which is the focus of the technology development presented in this research.

2.4.1 Sexual Health Policy in England

The first strategy for sexual health and HIV in England was published in 2001 against a national backdrop of increasing STI rates, high rates of unplanned pregnancies and attendances at Genito-Urinary Medicine (GUM) clinics doubling in the preceding 10 years (Department of Health, 2001). The strategy reflected the approach of the NHS Plan and its overarching direction was to: "redesign services around the people who use them" and aimed to:

- "improve services, information and support for all who need them;
- reduce inequalities in sexual health; and
- improve health, sexual health and wellbeing" (Department of Health, 2001:12).

Together with its implementation plan, published the following year, priorities for action included:

- placing a focus on prevention and health promotion, ensuring that information is available for people to be able to make informed decisions,
- modernising service delivery to enable more choice for people wanting to access sexual health services through the identification of commissioning leads for sexual health, creation of clinical networks for sexual health and piloting new models of delivery e.g. one-stop shops,
- structuring sexual health services within local health economies into the three service levels (basic, intermediate and specialist) that are still used today,
- introducing the intention to launch the NCSP (Department of Health, 2001, Department of Health, 2002).

The implementation of this strategy and the issues arising from it can be charted through the Health Select Committee Reports on sexual health and HIV/ AIDS and the government's response to them. The Health Select Committee report published in 2003 stated that "nothing in the evidence we have received convinces us that sexual health is yet accorded the priority it deserves… Despite a considerable investment by the government in targets to improve access to care and to improve health, sexual health is an area which seems to have fallen completely through the net… We therefore recommend that the Government takes urgent steps to ensure that access to high-quality sexual health services is prioritised and resourced." (House of Commons. Select Committee on Health, 2003:93).

The government response to this in the areas of STI testing and treatment included:

- the continued roll out of the NCSP to an additional 10 areas,
- additional investment in Genito-Urinary Medicine (GUM) services to increase capacity and reduce waiting times,
- the introduction of the GUM 48-hour access targets,
- additional investment to support laboratories moving to Nucleic Acid Amplification Tests (NAATs) for chlamydia (HM Government, 2003).

The 2005 report of the Health Select Committee which explored developments in Sexual Health and HIV/ AIDS policy applauded Government investment and action in terms of waiting times however it drew attention to a number of outstanding issues including:

- ability of the NHS to achieve the timescale,
- continued use of sub-optimal tests for chlamydia

- failure of Primary Care Trusts (PCTs) to ensure additional government funding for sexual health services is actually being spent on sexual health services,
- inadequate access to chlamydia screening for high risk populations (House of Commons. Select Committee on Health, 2005).

The government response to this included:

- an additional £300 million investment in sexual health services to ensure that GUM services could achieve the 48-hour access target by March 2008,
- accelerating the roll out of the NCSP so that 100% of England was covered by March 2007,
- further investment to support the migration of laboratories to the use of NAATs for chlamydia and mandatory use of NAATs as part of the NCSP (HM Government, 2005).

There was then a 12-year gap between the publication of the first dedicated sexual health strategy in 2001, and the publication of the Framework for Sexual Health Improvement in England in 2013, in readiness for the devolution of public health commissioning budgets to local authorities later that year. This stressed the importance of access to services and reducing STI rates as key objectives in achieving the ambition to "improve the sexual health of the whole population" (Department of Health, 2013b:10). It recognised the role that technology could have in supporting self-care for sexual health and future developments that would impact on service delivery, including point of care testing (POCT) and the developing mobile technology and smartphone apps for STI testing.

The 2013 strategy considered sexual health at different life-stages, and for the 16-24 age-range highlighted the need to prioritise prevention and ensure all young people:

- are informed so that they can make responsible decisions,
- can access appropriate sexual health services,
- have their sexual health needs met (ibid.).

To support the aim of reducing STIs, and recognising that chlamydia is the most prevalent STI in England with rates higher within the 16-24 age-range than any other, chlamydia detection rates within the 16-24 age-range has been set as a PHOF target for local authorities in England (ibid). The target detection rate is 2,300 diagnoses per 100,000 population as this is the rate determined by mathematical modelling to achieve a reduction in chlamydia prevalence (Department of Health, 2016b).

The NCSP featured heavily within the 2013 framework to reduce rates of STIs stating that in taking the programme forward in terms of service delivery there should be a focus on:

- "integrating screening into wider sexual health service provision and increasing screening in primary care, particularly general practice;
- restricting outreach screening to those young people with limited access to sexual health services;
- expanding internet testing services, which are particularly attractive to young men;
- promoting annual screening for young people (and additional testing on each change of partner)…" (Department of Health, 2013a:29).

2.4.2 Sexual Health Commissioning in England

As noted by the Health Select Committee 2003 report, the first national strategy for sexual health and HIV placed considerable emphasis on PCTs, the then commissioners of services, to implement the strategy. To support implementation the Department of Health and NCSP issued several best practice documents for PCTs to assist with their implementation of the new service requirements through commissioning arrangements. Commissioning responsibility continued with PCTs until the implementation of the Health and Social Care Act 2012, which led to the responsibility for commissioning sexual health services being split across three organisations in an area – Local Authorities(LAs), Clinical Commissioning Groups (CCGs) and NHS England (NHSE). The changes came into effect on 1 April 2013 and the responsibilities are summarised in table 2.2. This has produced a fragmentation in the delivery of services, most notably a split in responsibility for the treatment of HIV from other STIs and created a more complex landscape for technology developers to navigate depending on the scope of their development.

Local Authority	NHS England	CCGs
• STI testing and treatment, chlamydia testing as part of the National Chlamydia Screening Programme and HIV testing • Any sexual health specialist services, including young people's sexual health and teenage pregnancy services, outreach, HIV prevention and sexual health promotion work, services in schools, colleges and pharmacies	• HIV treatment and care, including post-exposure prophylaxis after sexual exposure • Promotion of opportunistic testing and treatment for STIs, and patient requested testing by GPs	• STI testing and treatment as part of the abortion pathway

Table 2.2 - Sexual Health Commissioning Responsibilities from April 2013 taken from (Department of Health, 2013a:16)

2.4.3 Epidemiology & Clinical Management of Chlamydia

The research presented in this thesis explored the adoption of two new technologies into chlamydia testing and treatment pathways. One of the key challenges in achieving a reduction in chlamydial infection is the lack of symptoms. In many cases people infected with chlamydia remain asymptomatic, in others symptoms appear weeks or months after infection (FPA, 2013). It is estimated that 70%-80% of young people with chlamydia will be asymptomatic with transmission possible through unprotected sex (Public Health England, 2014d).

Actions to reduce the transmission of STIs are varied and impact on different elements of the transmission dynamic. For example, increasing the use of condoms will reduce the likelihood of infection, targeted health promotion initiatives and partner notification may also impact on the rate of change of partners, and increasing testing within the population will contribute to a reduction in the duration of infectiousness. For chlamydia in England the NCSP has a key role to play in reducing transmission through its aim to screen 16-24 year olds annually or on change of partner (Public Health England, 2016b). Introduced in 2003, the NCSP is fundamentally different to all the other screening programmes in operation for adults because it is screening for an infectious disease.

It is also an opportunistic rather than population based screening programme meaning its target population are not invited to participate in screening directly through a recall programme. As well as securing a reduction in the prevalence of chlamydia, its objectives include informing sexually active under 25 year olds about chlamydia, normalising chlamydia screening and ensuring they have access to services (NCSP, 2012a).

Fewer young people are taking up chlamydia testing, and there has been reduction in positive diagnoses, although the pattern is complex. In 2015 there were 200,288 new diagnoses of chlamydia (Public Health England, 2016b). The four years' data available from current reporting systems indicate a small decline in the detection rate overall. Comparing 2014 and 2015 data, the detection rates are declining in the under 25 population and increasing in the over 25 population, although the number of diagnoses made is still significantly higher in the 15-24 age range (Public Health England, 2016d).

In respect of the NCSP, Public Health England (PHE) report the data captured for chlamydia tests aligned to the 15-24 age range separately. The headline data shows that in 2015 1,538,819 tests were undertaken in the 15-24 population, with a total of 129,022 positive tests (Public Health England, 2016b). Assuming one test per person, this equates to 22.5% of the population tested – 13% of males and 32% of females in the age range (ibid.). Considering the reduction in testing and diagnoses over the previous three years in the 15-24 age range, PHE suggest that the decline is a true decline "mostly attributable to fewer tests in non-specialist SHCs and community venues which may be, in part, a result of the integration of sexual health services in a number of programme areas" (Public Health England, 2016b:18).

Performance against the PHOF chlamydia detection rate indicator has also steadily declined over the last three years as summarised in table 2.3. This deterioration in performance has been consistently attributed to the relationship between testing coverage and diagnosis rate (Public Health England, 2016b). However, no link has been established between the transfer of commissioning responsibility from the NHS to LAs which took place in 2013.

	2013	2014	2015
Local Authority detection rate per 100,000	2,088	2,035	1,887
% of Local Authorities achieving PHOF indicator	30%	29%	20%

Table 2.3 - PHOF Achievement Data(Public Health England, 2016b, Public Health England, 2015, Public Health England, 2014d)

The detection rate per 100,000 population remains highest in the under 25 population. The highest rate is within the 20-24 age range for both men and women with a detection rate of 1,693.8 per 100,000 for men and 2,557.0 per 100,000 for women (Public Health England, 2016d). There is an even more marked difference in detection rates between men and women in the 15-19 age range with the female detection rate per 100,000 significantly higher at 2,463.8 compared with 824.4 per 100,000 for males in the same age range (ibid).

Of the diagnoses in 2015 with gender recorded, 58% were made in females (ibid.). Information regarding the ethnic origin of the population who tested positive is limited with 34% of diagnoses made in 2015 having an ethnic origin as 'unknown'; although this was an improvement on previous years (Public Health England, 2016e). Of those with their ethnicity recorded, 51% were categorised as White, 8% as Black or Black British, 2% as Asian or Asian British, 3% as mixed ethnic origin and 2% as 'other' (ibid.).

Information collected as part of the NCSP for the 15-24 age-range shows variation between regions in testing for chlamydia from 19% in the West Midlands and East of England to 27% in London (Public Health England, 2016b). This data shows that despite the aims of the NCSP, testing uptake to the desired levels is not being achieved. In developing new technology 'will people use it?' is an important consideration for both technology developers to optimise their technology, and both commissioners and providers in understanding the likely impact of technology introduction.

Estimates of the underlying prevalence of chlamydia in England are limited. Whilst PHE collect data on the population tested and the positive test results this does not equate to prevalence within the overall population. Mathematical modelling has identified that a detection rate of 2,300 per 100,000 population is required to deliver to a sustained reduction in chlamydia prevalence (Department of Health, 2016b) which is the rationale for the PHOF standard. The most comprehensive study of prevalence is the National Survey of Sexual Attitudes and Lifestyle (NATSAL), which is conducted every ten years. The results from NATSAL-3 (undertaken during 2010-2012) estimated a prevalence rate of 1.5% in men and 1.1% in women (Sonnenberg et al., 2013). This was higher within the 20-24 age-range in men and the 18-19 age range in women with estimated prevalence of 3.4% and 4.7% respectively (ibid). Prevalence is an important factor in estimating test performance and the long-term complications associated with untreated chlamydia. This is explored further in Chapter 8.

2.4.4 Pathways for the Testing & Treatment of Chlamydia

Service delivery pathways for the testing and treatment of chlamydia currently vary from locality to locality depending on the models commissioned by the LA and can involve single or multiple service providers. Examples of pathway options for chlamydia testing and treatment are shown on in figure 2.1, including GUM clinic, GP, Contraceptive and Sexual Health (CaSH) and NCSP internet testing. The proposed fully integrated remote pathway is also illustrated alongside this. The pathways illustrated are for the testing and treatment of asymptomatic patients. These pathways have been examined as part of the costing study and the two selected as comparator pathways are outlined further in Chapter 7. They have been broken down into six stages to ease comparison, and these stages are referred to throughout the thesis in the discussion of pathways.

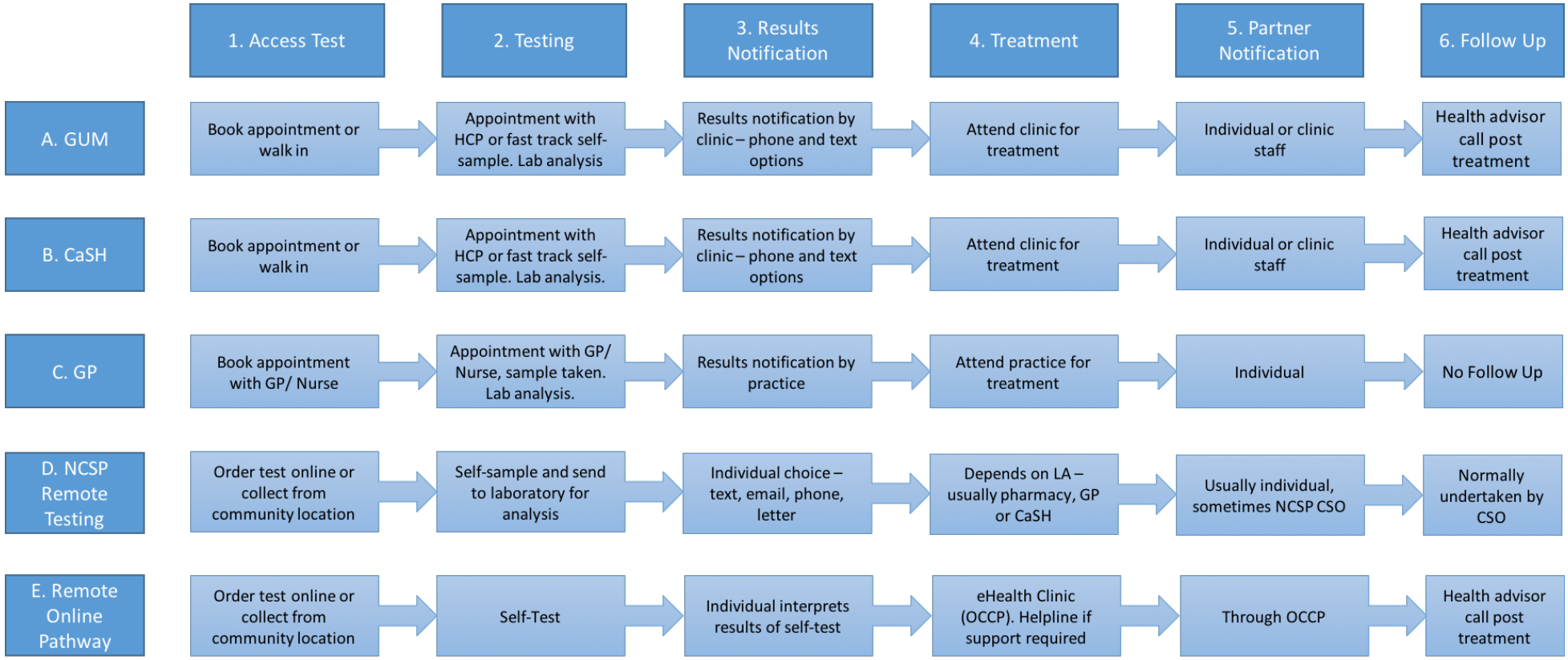

Figure 2.1 - Example Chlamydia Testing & Treatment Pathways

2.4.5 Diagnostic Testing for Chlamydia

A number of organisations are involved in determining standards and practice for chlamydia testing. Standards for microbiology investigations are published by PHE in association with the Royal College of Pathologists and other professional bodies, and testing guidelines for chlamydia are published by the British Association of Sexual Health and HIV (BASHH) (BASHH, 2010). The Medicines and Healthcare Products Regulatory Agency (MHRA) also play an indirect role in the approval of products in line with the In Vitro Diagnostic (IVD) Medical Devices Directive (MHRA, 2006). It appears that the majority of STI tests within the UK are analysed in a laboratory setting. NAATs are the standard required by the NHS for testing for chlamydia because they are recognised to have higher sensitivity and specificity than Enzyme Immunoassays (EIAs) (BASHH, 2010).

For chlamydia, NAATs can be undertaken using a range of specimen types, the recommended type for women is a vaginal or endocervical swab and men first catch urine or urethral swab (BASHH, 2010, Public Health England, 2014c). It is a requirement that the test must deliver a Positive Predictive Value (PPV) of greater than 90% or an additional confirmatory test is required (ibid.). The BASHH UK testing guidelines for chlamydia identify four laboratory based NAATs tests which are commonly used in the UK (BASHH, 2010).

STI testing was traditionally associated with clinician-collected samples however the development of NAATs testing has enabled patients to provide their own samples for the testing of chlamydia and gonorrhoea. Studies have shown that the performance of NAATs on self-collected urine, urethral or vaginal swabs is at least comparable with clinician-collected samples (Graseck et al., 2011, Sexton et al., 2013, Hocking et al., 2013).

Advances in technology have also enabled testing to move out of the laboratory and closer to the patient. A systematic review of studies published between 2010 and 2015 identified 10 POCT for chlamydia, with the authors identifying two tests – the 'Cepheid GeneXpert' and 'aQcare Chlamydia TRF kit' with a PPV of above 90% and sensitivity and specificity comparable with laboratory based NAATs tests (de Cortina et al., 2016). The remaining tests did not compare favourably with laboratory based NAATs due to either a low sensitivity or PPV (ibid.).

In January 2013 Cepheid announced that they had secured US Food and Drug Administration (FDA) approval for their GeneXpert combined chlamydia and gonorrhoea test (Cepheid, 2013). The FDA categorised this test as a 'test of moderate complexity' which meant it could be used in the USA within a hospital setting, however it did not meet the requirements of a 'waived test' – "so simple and accurate as to render the likelihood of erroneous results by the user negligible" (Cepheid, 2013:240). This is currently the only NAAT POCT for chlamydia approved by the FDA, comparable data for the MHRA is not publicly available on their website. The test operates on the same principle as laboratory based testing but can be used within a clinic setting and provides results within 90 minutes of testing.

Advances in microfluidic technologies have seen initial proof of concept for a number of lab-on-a-chip technologies in other areas such as hospital acquired infection, tuberculosis and HIV (Niemz et al., 2011). However, it is recognised that NAATs are one of the most challenging tests for this type of development "due to additional steps required for sample pre-treatment (e.g. cell sorting, isolation, and lysis, as well as nucleic acid extraction), signal amplification (due to low physiological concentrations) and target contamination and instability" (Niemz et al., 2011:2124).

There are currently no NAAT self-test products available for home use that deliver a chlamydia test result. There are examples of self-tests available, for example, Accunon Diagnostics Ltd offer home testing kits that deliver results in 15 minutes for diagnosing Chlamydia, Gonorrhoea, Hepatitis B, Hepatitis C and Syphilis, however these test kits are antibody (EIA) tests (Accunon Diagnostics Ltd, 2013). As highlighted previously the performance of EIA tests is inferior to NAAT tests and there are no EIA tests that are recommended for use in the UK testing guidelines (BASHH, 2010). For the self-test kits that are available there is currently no mHealth example providing diagnosis via a mobile phone.

2.4.6 Application of New Technologies in Service Delivery Pathways

As highlighted in section 2.3.2 sexual health services are one of the areas where there is widespread adoption of eHealth and mHealth services within England, both within mainstream sexual health services and in privately provided sexual health services.

Focusing in the first instance on mainstream sexual health services, results notification by text message has been adopted in many NHS clinics since the mid 2000s in response to the drive to achieve the 48-hour access target. Furthermore, an online search in 2015 identified a number of NHS providers offering some additional aspect of online sexual health services. These included appointment booking, online triage (directing to the most appropriate service e.g. http://www.icash.nhs.uk) and online clinics (via instant message e.g. https://www.sexualhealthvirtualclinic.co.uk).

As highlighted in section 2.4.5 there are currently no self-tests (stage 2 in figure 2.1) available for chlamydia which have a suitable accuracy. There is however a self-test option available for HIV. In April 2014, regulations were relaxed to allow the sale of HIV self-test kits in England. There is currently one CE marked self-test available, the Biosure HIV self-test (National AIDS Trust, 2015). However, although the self-test can indicate that a person may have HIV, a confirmatory laboratory test is still required (ibid).

In respect of test ordering and testing (stages 1 and 2 in figure 2.1), many localities use an online service for chlamydia (and in some cases gonorrhoea) testing for the 16-24-year-old population. Services such as freetest.me and checkurself.org.uk enable online ordering of a test kit for self-sampling and provide a freepost envelope for the sample to be sent to the laboratory for analysis. Freetest.me also provides an online results notification service. Data published by PHE indicates that 5% of chlamydia tests undertaken as part of the NCSP were ordered online (Public Health England, 2016b). Both services provide stage 1 and 2 (figure 2.1) in the pathway only, they do not incorporate the treatment (stage 4) online.

There are some examples of broader eHealth and mHealth sexual health service provision in mainstream sexual health services. For example, checkurself launched a new service in 2016 for a number of London boroughs which includes over 25s and a broader range of STI tests including HIV, chlamydia, gonorrhoea, Hepatitis B and C, and syphilis (Checkurself, 2016).

However, there are more extensive examples of integrated online provision in the private healthcare sector, with several online pharmacies including Lloyds, Boots and Superdrug offering online testing and treatment (stages 1-5, figure 2.1). For stages 1 and 2, the online testing component operates the same model as checkurself and freetest.me and for stage 3, results are made available online. The treatment component (stage 4) is offered differently to the NCSP internet testing services, with patients able to complete an online form to secure treatment for chlamydia, gonorrhoea, herpes and genital warts which is reviewed by a GP (Lloyds Pharmacy, 2016). In 2015, private sector online sexual health treatment services came under heavy criticism for the prescription of oral antibiotics for the treatment of gonorrhoea (Kirkland, 2015, BASHH, 2011). Oral treatment may be ineffective due to antimicrobial resistance and sub-optimal when compared with the national treatment guidelines for gonorrhoea (BASHH, 2011, Kirkland, 2015). Whilst this is occurring in the private sector, there is no evidence of this occurring in the treatment of gonorrhoea in mainstream sexual health services.

There are limited examples of the use of POCT in mainstream sexual health services for chlamydia (services A,B & C in figure 2.1). A published service evaluation of the use of the Cepheid GeneXpert undertaken in a UK GUM clinic found that due to the 90 minute processing time only 14.3% of males and 28.6% of females waited to receive their results (Harding-Esch, 2013).

2.4.7 Considerations in the Cost-Effectiveness of Chlamydia Testing & Treatment

Over the past 25 years there has been a wealth of literature published exploring the costs and benefits of chlamydia testing and treatment, much of this focused on the impact of opportunistic or population based screening programmes. Starting with the testing stage of the pathway Hislop and colleagues have explored the impact of introducing EIA POCT into family planning settings in the UK and concluded that this is not presently clinically or cost-effective (Hislop et al., 2010). This is in contrast to Turner and colleagues who find that the new generation NAAT POCT are potentially cost saving with a small increase in QALYs and major outcomes averted (Turner et al., 2014). The primary difference between the two studies is the performance characteristics of the tests considered, the EIA POCT considered by Hislop and colleagues has a considerably lower sensitivity and specificity than the NAAT POCT considered by Turner and colleagues.

To illustrate another potential impact of test performance characteristics on the cost-effectiveness of chlamydia testing, Gift and colleagues explored the 'rapid test paradox' using a scenario in which laboratory tests have greater sensitivity than rapid tests however the loss to follow up is greater. Their findings suggest that if there is a loss to follow up of greater than 35%, a less sensitive rapid test (63% v's 94%) would lead to the treatment of more chlamydia positive patients than the laboratory test (Gift et al., 1999).

Fewer studies have considered integrated online provision (service model D & E in figure 2.1). One study in America has explored the cost-effectiveness of internet based sample collection versus clinic based testing and found the internet based strategy to be cost-effective (Huang et al., 2011). Two studies have been identified considering the use of the internet in a full chlamydia testing and treatment pathway, the UK based study concluding the pathway piloted is not clinically or cost effective compared to the existing NCSP pathway (Bracebridge et al., 2012), and an American based study operating a similar pathway concluding that it has the potential to be a cost-effective alternative to clinic based screening (Spielberg et al., 2014). Neither of these studies however consider an eHealth solution which enables the prescribing of chlamydia treatment without the involvement of a prescriber.

Two systematic reviews of the cost-effectiveness of chlamydia screening have both concluded that chlamydia screening is cost-effective. One covering the period 1990-2000 (Honey et al., 2002), and one covering the period until August 2004 (Roberts et al., 2006). Subsequent to this review, the European Centre for Disease Prevention and Control (ECDC) published a comprehensive literature review examining chlamydia control in Europe. As part of this literature review, they updated the Roberts and colleagues review to February 2012. This update identified a further 10 studies, all except one demonstrated that a form of chlamydia screening, for example female only or male and female, repeated or one-off opportunistic would be cost-effective (ECDC, 2014).

2.5 Summary

This chapter has set the scene for the research presented in this thesis. Despite it being almost fifteen years since the first published definition of eHealth, there is a limited evidence base demonstrating effectiveness. The pace of technology development means that there are constantly new products for evaluation, which set against the time constraints of traditional approaches to clinical and economic evaluation are the most likely reason there is an absence of a strong evidence base upon which the NHS and other health systems can take decisions to commission eHealth and mHealth technologies. However, this lack of evidence base must be balanced against the potential of the new technology particularly given the high proportion of the population with access to the base technology e.g. the internet and a smartphone within England.

Strategies for increasing testing and treatment uptake for chlamydia are of importance to sexual health commissioners, against a backdrop of both declining test uptake and an increasing proportion of LAs failing to achieve the chlamydia detection rate PHOF indicator. As well as being aligned to DH digital policy, eHealth and self-testing are recognised future developments that will have a key impact on service delivery within the current government framework for improving the sexual health of the population.

A review of the availability of eHealth/ mHealth and testing products has not identified any NAAT self-tests for chlamydia, or eHealth delivery models that remove a clinician from the care of the patient where it is safe to do so, as an OCCP would do, but it has identified a small number of examples of the use of eHealth within both NHS and private sector sexual health services. No self-test kits have been identified which meet the chlamydia test standards identified for use in England.

Within the context of current healthcare policy, availability of products and service delivery models for chlamydia testing and treatment there are two important considerations identified for this research. Firstly, whether if the new technology were available for testing and treatment, would it be used by the target population and secondly would it be cost saving and improve outcomes compared to existing service options. The next chapter sets out the methods used to address the overall research objectives outlined in section 1.3.

CHAPTER 3 – METHODS

3.1 Introduction

"There are two key gaps in the translation of health research into improvements in practice that generate health and economic benefits: translating ideas from basic and clinical research into the development of new products and approaches to treatment of disease and illness; and implementing those new products and approaches into clinical practice" (Cooksey, 2006:35).

The purpose of this chapter is to outline the overarching methods and approach used to address the research objectives:

- *To assess which attributes influence young people's preferences for the testing and treatment of chlamydia and to explore their implications for the development of sexual health services in England,*
- *To explore the likely costs of implementing online chlamydia treatment in mainstream sexual health services in England,*
- *To develop an economic model to assess the likely costs and benefits of implementing a fully remote, integrated online pathway, including self-testing.*

This chapter sets out the methods selected for this research and the rationale for this, the role of the researcher and how this shaped the research undertaken. Several methods were used in this doctoral research including literature reviews, focus and expert groups, cognitive testing, discrete choice experiment, interviews, pathway mapping, costing and economic modelling. Further information on the detailed implementation is presented in the relevant chapter.

3.2 Overview of Research

As an NHS manager, undertaking research that will add to the evidence base to inform decision making by commissioners and service leads on pathway redesign was a key driver in the finalisation of the research questions and selection of methods for this doctoral research. A pragmatic approach was adopted to address the research questions, recognising that this is highly aligned to the mixed methods approach adopted.

The chlamydia testing and treatment pathways being explored in this thesis are undoubtedly complex interventions, defined by the MRC as "interventions with several interacting components" (Medical Research Council, 2008:6). They further outline the issues associated with evaluating this type of intervention as being "the difficulty of standardising the design and delivery of interventions, their sensitivity to features of the local context, the organisational and logistical difficult of applying experimental methods to service or policy change, and the length and complexity of the causal chains linking intervention with outcome" (ibid.). This research was conducted within the context of the framework of HTA, specifically eHTA. Whilst not conducting a full eHTA, the research focused on two elements to inform an eHTA – a DCE to measure young people's preferences (to inform likely uptake) and early economic evaluation (to estimate the costs and consequences associated with different pathways).

A number of individual pieces of research were undertaken which came together to inform both the DCE and the economic evaluation, including a link between the two where the probabilities derived from the DCE results were used to inform sensitivity analysis in the economic evaluation. To guide the reader through the following sections, a summary of the research undertaken by the author and presented in this thesis is outlined in table 3.1. This doctoral research was undertaken as part of a UKCRC strategic grant aimed at developing a fully remote online pathway for STI testing and treatment. A more detailed description of the full work programme is included in Appendix 1.

Research/ Study	Role in Design	Role in Data Collection	Role in Analysis
DCE Literature Reviews	I designed the literature review protocols for the two literature reviews which enabled the identification of the long list of attributes for the DCE	I ran the searches in electronic databases and recorded outputs in Endnote X6. I applied the inclusion and exclusion criteria to arrive at the final set of included studies.	I extracted data from the included articles and applied a quality checklist to the stated preference studies literature review.
DCE Focus Groups	I developed the study protocol for the development of the DCE questionnaire which included the topic guide, participant information leaflets and ethics committee requirements.	I conducted and transcribed the four focus groups.	I developed the coding framework and analysed the focus group transcripts.
DCE Expert Groups	Part of the study protocol outlined above.	I led the expert groups and summarised the key discussion points.	I synthesised the findings alongside other data sources to inform the final selection of attributes and levels
DCE Cognitive Testing	Part of the study protocol outlined above	I undertook the cognitive interviews	I analysed the cognitive interviews and modified the DCE questionnaire based on the analysis.
DCE Questionnaire Design	I developed the final DCE questionnaire design and secured ethics committee approval for its conduct including the development of the study protocol.	I worked with an independent research company and used their online consumer panel. The company provided the raw data from the completed questionnaires.	I undertook the validity checks and analysis of the questionnaire data.
Costing Study – Literature Reviews	I designed the literature review protocols for the literature reviews to review health economic models for chlamydia and identify parameter inputs for the model.	I ran the searches in electronic databases and recorded outputs in Endnote X7. I applied the inclusion and exclusion criteria to arrive at the final set of included studies.	I extracted data from the included articles.
Costing Study – Primary Data Collection	I developed the study protocol and secured ethics approval for the collection of the primary data (interviews) on the resource inputs, performance and costs of comparator pathways for the economic analysis	I undertook the interviews and mapped pathways	I used the data sourced to build up cost inputs for the costing study and undertook sensitivity analysis on identified parameters.
Economic Evaluation	I conceptualised and built the economic model	I undertook the literature reviews to parameterise the model	I undertook the validity checks, analysed the data from the model and undertook sensitivity analysis on identified parameters.

Table 3.1 - Summary of Research Undertaken and Presented in this Thesis

The remainder of this chapter presents the background to the theoretical framework for the consideration of the research objectives, the methods selected and the justification for the selection of these methods.

3.3 Health Technology Assessment

The evaluation of new healthcare technology, be that drugs, devices, diagnostics, procedures or other interventions, and its impact on clinical care pathways is desirable prior to large-scale implementation within the NHS to minimise the associated risk. Szczepura and Kankaanpää recognise that HTA has the potential to address the translational research deficit identified by Cooksey in that it presents an opportunity to "look before you leap" into widespread implementation of a new technology within a health service (Szczepura and Kankaanpää, 1996:5).

eHTA recognises the value of an assessment of the likely costs for technology developers in particular (Pietzsch and Paté-Cornell, 2008). An insight into the cost impact of the implementation of the technology to the healthcare system can inform future development and likely issues to be addressed to achieve adoption. This section sets out the background to HTA, giving context to the research included in this doctoral thesis.

HTA is "the systematic process by which the direct and *indirect* consequences of a particular technology are assessed; it is concerned with evaluating the safety, effectiveness, and cost-effectiveness, and (where appropriate) the social, ethical and legal impact of a technology" (Szczepura and Kankaanpää, 1999:4-5). EUnetHTA, a network of European HTA agencies, cites the aim of HTA as being "to inform the formulation of safe, effective, health policies that are patient focused and seek to achieve best value" (EUnetHTA, 2015a:e1).

Goodman extends this, acknowledging that there are many reasons that HTAs are undertaken including to advise or inform:

- whether a technology should be approved by a regulatory agency or adopted by a health care system e.g. whether the NHS should fund,
- guideline development on the use of a technology within clinical practice,
- manufacturers on the development of a technology and its positioning within the market (Goodman, 2014).

Within the context of the reason for undertaking an HTA, Goodman identified three 'basic orientations to HTA':

- Technology-oriented - to explore the impact of a specific healthcare technology,
- Problem-oriented – to identify solutions to a specific problem, for the management of a particular condition,
- Project-oriented – to adopt a local focus e.g. to consider the adoption of a technology by a particular organisation (ibid.).

Within the context of these orientations the most commonly recognised application of HTA is the technology oriented approach undertaken by HTA agencies.

The definition outlined by EUnetHTA offers some insight into the scope of information considered within an HTA, however there are variations within the clarification of scope of what HTA assesses, as outlined in the table 3.2:

Scope of HTA Assessment	Source
"May involve the investigation of one or more properties, impacts, or other attributes of health technologies or applications. In general these include the following: • Technical properties • Safety • Efficacy and/ or effectiveness • Economic attributes or impacts • Social, legal, ethical and/or political impacts"	(Goodman, 2014:II5-6)
"Domains of an HTA: • Health problem and current use of technology • Description and technical characteristics of the technology • Safety • Clinical Effectiveness • Costs and economic evaluation • Ethical analysis • Organisational aspects • Social aspects • Legal aspects"	(EUnetHTA, 2015b:6)
"Definition of the research questions: • Safety • Efficacy/ Effectiveness • Psychological/ Social/ Ethical • Organisational/ Professional • Economic"	(Busse et al., 2002:365)

Table 3.2 - Scope of Health Technology Assessment (Busse et al., 2002, Goodman, 2014, EUnetHTA, 2015b)

Within the scope outlined in table 3.2 there are a number of outcomes that can form part of the HTA which are summarised in the figure 3.1:

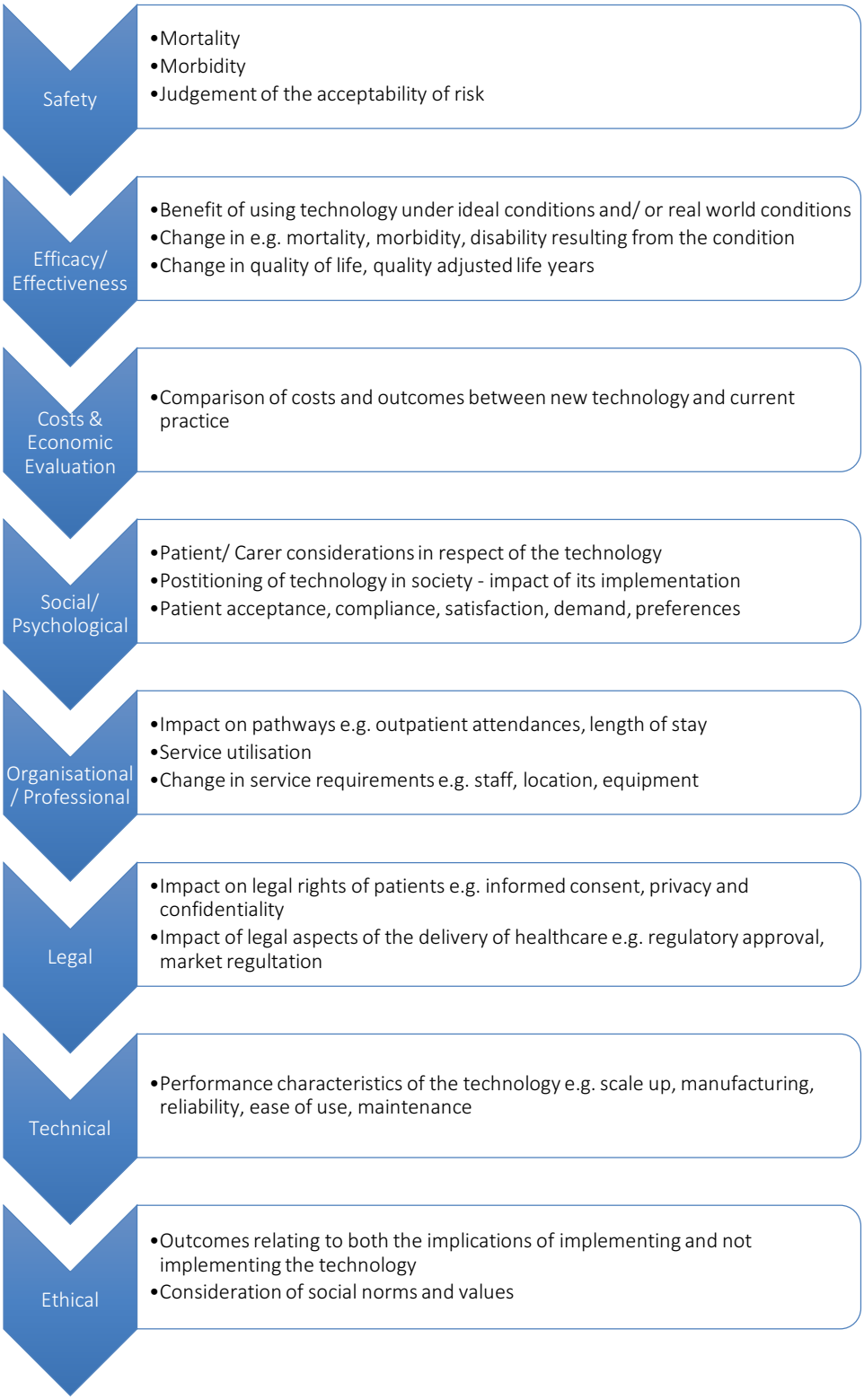

Figure 3.1 - Summary of Outcomes Considered in HTA adapted from Busse et al., (2002), Goodman, (2014), EUnetHTA, (2015b)

In England, the National Institute of Health and Care Excellence (NICE) carries out evaluation of the key innovative or high impact technologies. NICE operate a number of technology assessment programmes including:

- the technology appraisal programme (TA),
- the medical technologies evaluation programme (MTEP),
- the diagnostics assessment programme (DAP),
- the highly specialised technologies programme (HST),
- the interventional procedures programme (IP) (NICE, 2015).

It is a requirement for commissioners in England to comply with recommendations made in respect of drugs and devices through the TA and HST programmes within three months of recommendation. However, the recommendations of all other technology assessment programmes are advisory only at the moment, that is the decision rests with the commissioner, be that NHSE, CCGs or the LA (ibid.). Regardless of the decision taken in respect of a new technology by commissioners, individual clinical practice of medical staff is a significant factor in medical technology uptake.

Diagnostic technology evaluation is undertaken through the DAP or MTEP. To date no evaluation of an eHealth or mHealth technology has been considered by NICE. Work is ongoing between a number of agencies including NICE, PHE, NHS England and NHS Digital on the processes and methods for the evaluation of apps (Osipenko, 2016).

Whilst it is recognised that the theory that NICE technology assessments will act as “filters for new technology and then as catalysts for adoption” (Liddell et al., 2008:viii) there are limitations due to NICE’s capacity to evaluate only a limited number of products. Many other technologies end up in the hands of hundreds of commissioning and provider organisations where local decisions are required.

This has implications both for NICE recommended technologies that are not subject to mandatory funding (MTEP/DAP/IP recommendations) and for the many technologies that are not assessed by NICE.

For healthcare commissioning organisations the approach taken is normally set out within policies on in year service developments which restrict how new service developments are adopted, for example, NHS England's Policy on 'in year' service developments (NHS England, 2013) and Clinical Priorities Advisory Group (NHS England, 2016). Within local authorities commissioning decisions are made within the committee governance structure with elected members determining the outcome.

For healthcare provider organisations adoption is normally assessed through the business case process, whereby directorate teams develop a business case which identifies the costs, benefits and service delivery implications of the adoption of a new technology. Whilst variable in scale, business cases broadly cover the key principles set out in the green book (HM Treasury, 2013).

Considering the HTA process for the fully remote integrated pathway (pathway E, stages 1 and 2 in figure 2.1), should the associated diagnostic technologies be considered by NICE they would fall within the scope of the MTEP or DAP. These would most likely be subject to local evaluation by commissioners and providers.

In terms of the OCCP (pathway E, stage 3 onwards in figure 2.1), whilst there are well-established programmes for the evaluation of pharmaceutical products, and to a much lesser extent devices and diagnostics, health technology assessment and economic evaluation of online provision (eHealth and mHealth initiatives) is largely untested (Tate et al., 2009, Free et al., 2013a).

This view is reinforced by the WHO who identify that the implementation of mHealth is taking place through localised, small scale pilots on an ad hoc basis with minimal evaluation (WHO, 2011a).

Kidholm and colleagues undertook work with stakeholders and user groups to consider the application of the EUnetHTA core model to telemedicine, their resulting MAST model is outlined in figure 3.2:

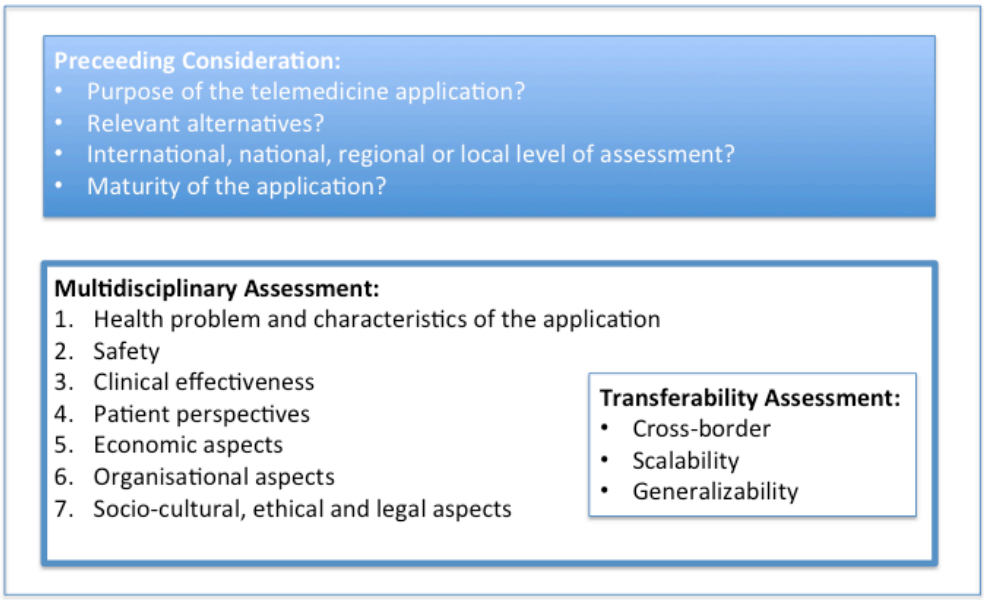

Figure 3.2 - The Elements of the MAST model for Telemedicine HTA. Source: (Kidholm et al., 2012:47)

The principal differences between the MAST model and the EUnet HTA model are a reduction in the number of domains through the consolidation of the health problem and technology characteristics into one component, and the rationalisation of the ethical, social and legal aspects into another. A 'patient perspectives' component has been added, noting that this was a specific request resulting from the stakeholder work, driven by a belief that the model required simplification (Kidholm et al., 2012). No published studies could be identified which used the MAST model as a framework for HTA.

3.4 Early Health Technology Assessment

Unlike HTA, there is no standard definition offered within the literature for eHTA. Pietzsch and Paté-Cornell identify the aim of eHTA as being the same as HTA, only it is an assessment of the *likelihood* of the safety, effectiveness and cost-effectiveness of a new technology (Pietzsch and Paté-Cornell, 2008). Literature on the methods and practice of eHTA has emerged in recent years, borne out of the recognition of the uncertainty faced by developers in waiting for regulatory approval. Pietzsch and Paté-Cornell highlight that this uncertainty could be reduced by undertaking eHTA "at the time when major investment and design decisions are made" (Pietzsch and Paté-Cornell, 2008:36). In considering the scope of HTA and eHTA, Pietzsch and Paté-Cornell identify the following similarities and differences, summarised in table 3.3:

	HTA	eHTA
Aim	Assess safety, effectiveness, and cost-effectiveness profiles of a new technology	Assess (likely) safety, effectiveness, and cost-effectiveness profiles of a new technology
Decision Support	Decision support for regulators, payers and patients about market clearance, payment and usage of a technology	Decision support for manufacturers and investors about design and management of a technology, as well as regulatory and reimbursement strategy
Available Evidence	Usually evidence from clinical studies performed with new technology	Evidence from early bench and animal testing, early clinical experience, and from previous generations of the technology
Influence on Technology Performance	Limited or no influence on clinical performance of a new technology	Potentially significant influence on (future) clinical performance of a new technology

Table 3.3 - Similarities and Differences between HTA and eHTA. Taken form Pietzsch & Paté-Cornell, (2008:37)

Ijzerman and Steuten (2011) break this down further, proposing three stages of HTA within the four stages of the product development lifecycle – very eHTA, eHTA and HTA (figure 3.3). This has rarely been seen in practice in published literature, for example Dong and Buxton's early assessment of the likely cost-effectiveness of computer-assisted total knee replacement (Dong and Buxton, 2006), O'Prinsen and colleagues consideration of a new medical technology for stroke rehabilitation (O'Prinsen et al., 2009), and Vallejo-Torres and colleagues application of a three-stage economic evaluation to absorbable pins for Hallux Valgus (Vallejo-Torres et al., 2011).

Cosh and colleagues identified a decision framework for companies considering investing in new medical technology (Cosh et al., 2007). This includes strategic consideration, clinical problem definition, headroom analysis, return-on-investment analysis and further economic evaluation, positioning the use of the model at the eHTA stage.

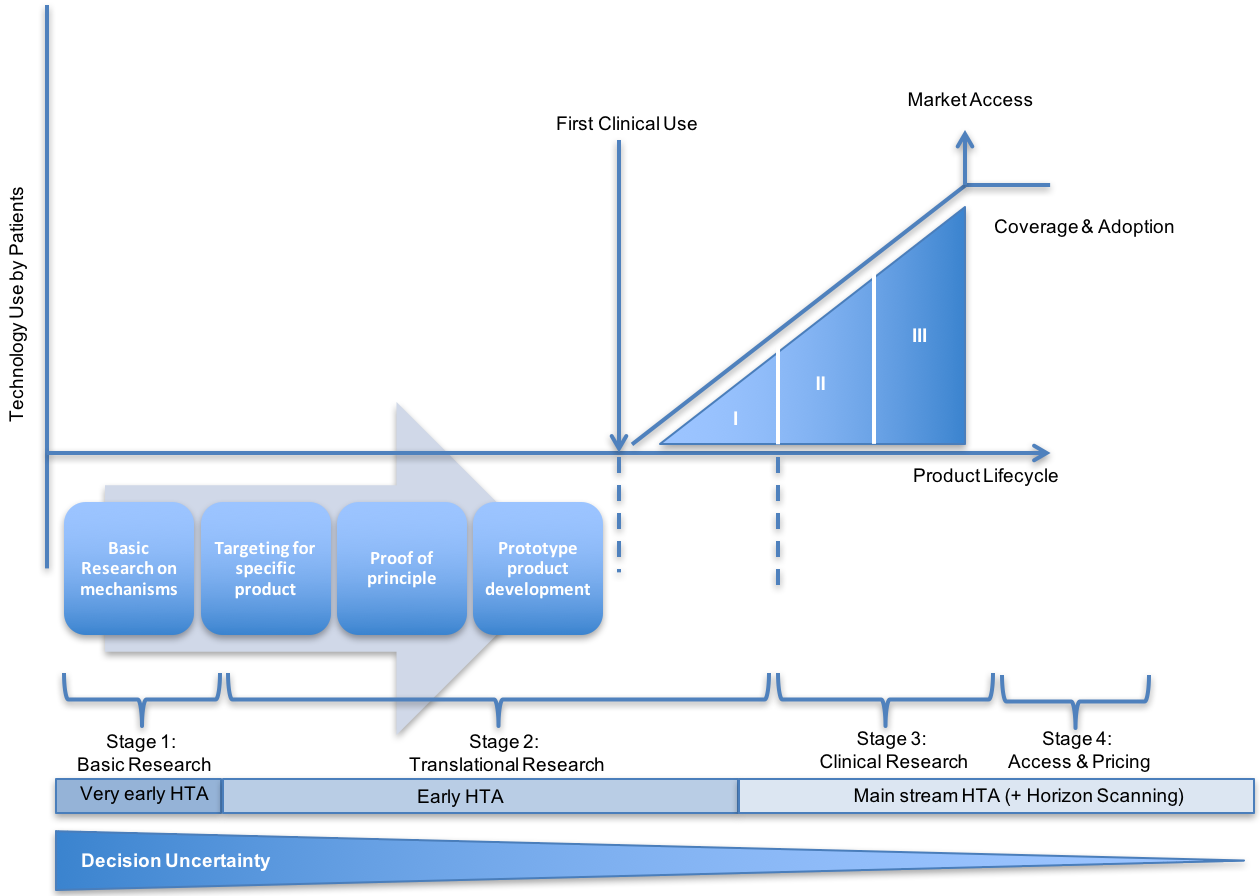

Figure 3.3 - Applying HTA to Stages of Product Development. Source: Ijzerman and Steuten, 2011:335

The evolution of HTA and economic evaluation is centred primarily on the evaluation of drugs rather than devices or other health technologies such as telemedicine, eHealth or mHealth (Tate et al., 2009, Free et al., 2013). Pecchia and Craven identify a number of key factors which impact on HTA that differ between the drug and device product groups including product life cycle, clinical evaluation, use issues and cost (Pecchia and Craven, 2012).

Whilst no published studies were identified which apply the use of an iterative economic evaluation approach in the development of an e/mHealth intervention, there is some evidence of the adoption of this approach in respect of biomedical devices. Considering the differences highlighted, eHealth and mHealth technologies with their constantly evolving product and 'user dependent efficacy' are much more closely aligned with devices than drugs (Pecchia and Craven 2012).

This is also consistent with a lack of published economic evaluations of eHealth and mHealth. A review of the cost-effectiveness of internet interventions published in 2009 concluded that "whilst there is a growing body of outcome literature on internet interventions, this review reveals that only a limited number of studies so far have attempted to incorporate economic endpoints into the analyses and most have significant shortcomings" (Tate et al. 2009:42). A recent systematic review of literature on the cost-effectiveness of telemedicine, eHealth and mHealth systems found that there were too few studies, many of poor quality, to determine whether these technologies are cost-effective (de la Torre-Díez et al., 2015).

An earlier scoping review undertaken as part of this doctoral research (not included in the thesis) in 2013 to identify whether eHealth/mHealth initiatives for diagnosis, treatment and monitoring are cost effective identified only three economic evaluations, reported alongside, but secondary to, the clinical effectiveness evaluation (Ryan et al., 2012, van Os-Medendorp et al., 2012, Isetta et al., 2013).

3.5 Approaches to Economic Evaluation

Economic evaluation is defined by Drummond and colleagues as "the comparative analysis of the alternative courses of action in terms of both their costs and consequences" (Drummond et al., 2015:4). They identify five principal approaches to the measurement of costs and consequences in economic evaluation, noting that in all cases costs are valued as monetary units, however the identification and measurement of consequences is different, depending on the approach. The authors acknowledge the growth of a further form of economic evaluation - cost-consequence analysis which is a form of cost-effectiveness analysis. The types of economic evaluation are presented in table 3.4.

Type of Economic Evaluation	Defining Features	Example in an STI context
Cost Analysis	Consequences are not included in the analysis	Cost analysis of the Prevention of Pelvic Infection Trial, explored the impact of chlamydia screening on pelvic inflammatory disease (Aghaizu et al., 2011)

Type of Economic Evaluation	Defining Features	Example in an STI context
Cost Minimisation Analysis (CMA)	Consequences between the alternatives under consideration are "broadly equivalent" (Drummond et al, 2015:6), therefore the analysis is reduced to a comparison of costs	Cost minimisation analysis to compare 12 or 24 weeks of drug therapy for Hepatitis C (De Compadri et al., 2008)
Cost Effectiveness Analysis (CEA)	One consequence, the same for both alternatives, which is measured in natural units (e.g. increase in cases detected)	Cost effectiveness analysis of screening for chlamydia by internet ordered self-sample compared with clinic based clinician sample (Huang et al., 2011)
Cost Utility Analysis (CUA)	Single or multiple effects which do not have to be common to both alternatives. Effects are measured in 'healthy years', usually quality adjusted life-years (QALYs)	The costs and cost effectiveness of introducing an opportunistic screening programme in Ireland (Gillespie et al., 2012)
Cost Benefit Analysis (CBA)	Single or multiple effects which do not have to be common to both alternatives. Effects are measured in monetary units.	Cost benefit analysis of screening all 15-24 pregnant women in the USA for chlamydia (Ditkowsky et al., 2017)
Cost Consequence Analysis (CCA)	This is a form of CEA and takes the form of "a comparative evaluation of the costs and resource use consequences of two or more interventions considered alongside the relevant clinical benefits" (NICE 2011b:25). This enables the decision maker to "make their own trade-off between effects" (Drummond et al., 2005:103).	Comparison of the costs and outcomes of two STI screening interventions undertaken in a football club setting (Jackson et al., 2015)

Table 3.4 - Types of Economic Evaluation (Drummond et al., 2005, Drummond et al., 2015)

The primary form of economic evaluation adopted by NICE in its HTA programmes is CUA, with the main technology appraisal programmes all incorporating this approach, with the exception of the MTEP which uses CCA (NICE, 2011b). The rationale for this is not explained in full, although it is stated that this approach is the most appropriate for HTA within this programme.

Whilst NICE's focus in economic evaluation is on the final HTA stage (figure 3.3), when the technology is sufficiently developed to be adopted by the NHS, Sculpher and colleagues had earlier outlined the benefits of adopting an iterative approach to economic evaluation which can also be aligned to earlier stages of product development. They argue that "just as clinical evaluation progresses through various stages, with the choice of research method depending on the maturity of the technology and the nature of existing uncertainties, economic evaluation too should be viewed as a continuous process over time, progressing from early 'indicative' studies to rigorous comparative analysis" (Sculpher et al., 1997:26). Their four-stage approach is summarised in figure 3.4:

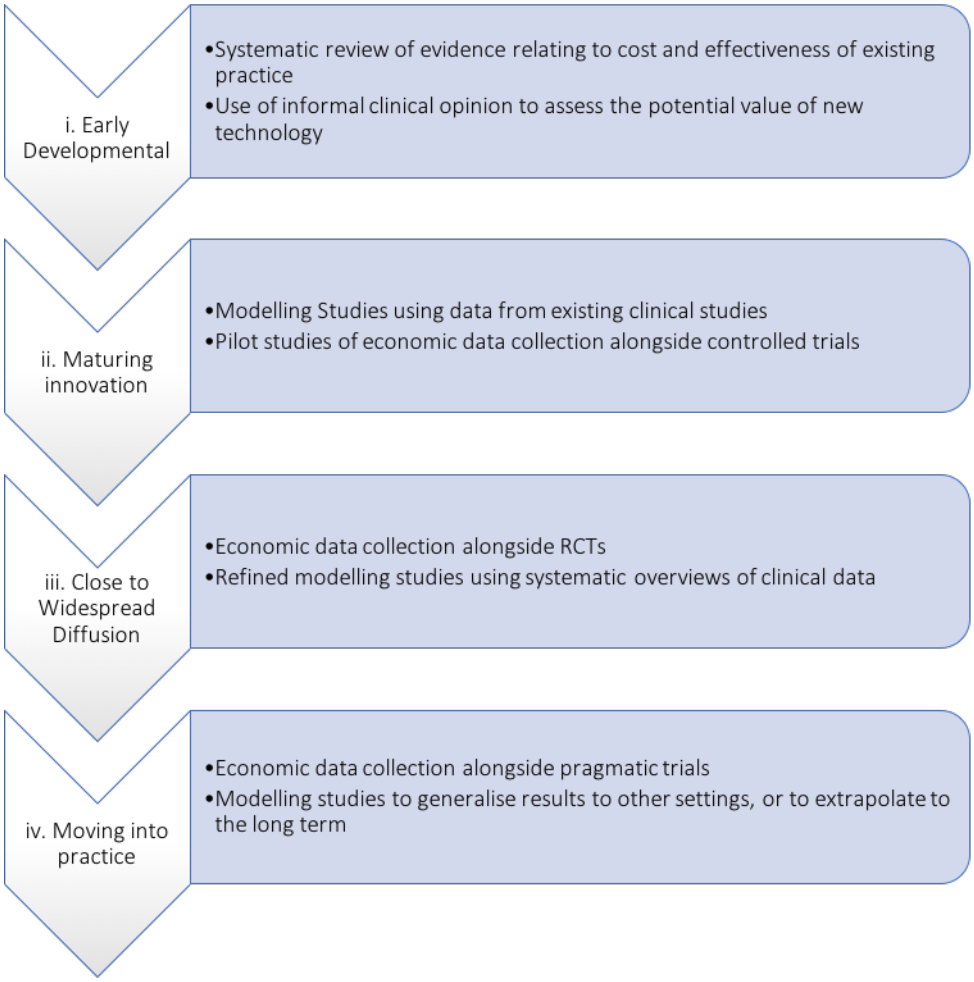

Figure 3.4 - Stages of Economic Evaluation in Health Technology Assessment, adapted from Sculpher et al., (1997:27)

The stages of economic evaluation outlined by Sculpher and colleagues can be aligned with the four stages of product research and HTA types outlined by Ijzerman and Steuten, as summarised in table 3.5:

Stage	Product Development Stage	Health Technology Assessment Type	Economic Evaluation Stage
1	Basic Research	Very early HTA	Early Developmental
2	Translational Research	Early HTA	Maturing Innovation
3	Clinical Research	Mainstream HTA	Close to Widespread Diffusion
4	Access & Pricing	Mainstream HTA	Moving into Practice

Table 3.5 - Mapping Stages of Product Development, HTA and Economic Evaluation (Ijzerman & Steuten, 2011, Sculpher et al., 1997)

Hartz and John explored the contribution of economic evaluation to decision making in the early stages of product development and noted the following key areas where it is applied:

- "Strategic research and development decision making
- Pre-clinical preliminary market assessments
- Go/ no-go decisions, identification of potentially success projects
- Development of future trial design
- Assessment of future reimbursement and pricing scenarios
- Price determination" (Hartz and John, 2008:466-468).

Through their literature review, Hartz and John identified a number of techniques used in early economic evaluation including early economic modelling, Bayesian decision theory, value of information analysis and clinical trial simulation. However, of the 83 papers included in their review, 70% were early economic evaluations of drugs and 30% were other interventions including "surgery, imaging or novel products of systems" (Hartz and John, 2008:469). It is recognised that those different categories of interventions have different needs from eHTA, including economic evaluation (Pecchia and Craven, 2012).

For medical devices, Girling and colleagues have developed a framework to undertake early economic evaluation (Girling et al., 2010). They used a two-stage model based on the product development cycle, with investment decision gates at the end of the concept stage (Stage 1 in table 3.5) and clinical research stage (Stage 3 in table 3.5).

The method used to underpin the model is headroom analysis and the key difference between the two stages in the model is the consideration of different forms of uncertainty: developmental uncertainty "those aspects of product design and performance that will be resolved during the development phase" (Girling et al., 2010:586), and post-market uncertainty "those aspects of commercial performance that will not be resolved in time to influence the decision to launch the product into the marketplace" (ibid.), for example price and volume of sales. Headroom can be defined as "the most the manufacturer could charge whilst securing funding from the care provider" (Girling et al., 2015:332).

It is suggested that the time to calculate headroom is at the market entry point (ibid.), however Vallejo-Torres highlight its successful use during the first stage of a three-stage iterative economic evaluation alongside a product development (Vallejo-Torres et al., 2011).

Considering the technologies included in the fully remote online pathway (Pathway E in figure 2.1) against the stages outlined in table 3.5, they are currently at different stages of development:

- Self-test – The self-test is at a very early development stage. Techniques for the component elements of self-tests are still being developed e.g. sample collection and amplification (eSTI2 Consortium, 2011).

- OCCP – A basic product exists which has been piloted in an exploratory study in the NHS, generating preliminary data about its effectiveness (Estcourt et al., 2015a).

This assessment of the product development stage has been used to inform the selection of methods for considering the costs and benefits of implementing the new technologies outlined in the following section.

3.5.1 Methods Chosen for Exploring the Costs and Benefits of implementing a Fully Remote Online Pathway for Chlamydia

The methods finally selected reflect the stage of technology development, and specific methodological issues identified in the consideration of the costs and benefits of asymptomatic chlamydia testing and treatment. There are two linked pieces of research presented in this thesis, firstly a preliminary evaluation of the costs and outcomes for the delivery of an OCCP which is presented in Chapter 7.

This included some data from an exploratory study undertaken in London by the eSTI^2 consortium. Secondly, Chapter 8 outlines an economic model for a fully remote online pathway (Pathway E in figure 2.1) to explore the costs and consequences of the introduction of this. The model considered the longer-term impact of the health complications associated with untreated chlamydia.

Methods for costing health services and their strengths and weaknesses are well documented in the literature (Drummond et al., 2015, Gray et al., 2011, Mogyorosy and Smith, 2005). There is a consensus that there are three distinct steps within the process of costing– identification, measurement and valuation (Drummond et al., 2015, Gray et al., 2011). However, Mogyorosy & Smith suggest two further steps prior to commencing costing that have a critical role to play in setting the perspective of the costing and framing the service to enable the accurate identification of costs. Their five step approach is summarised in figure 3.5 and further information on the detail of each stage is outlined in 7.2.1.

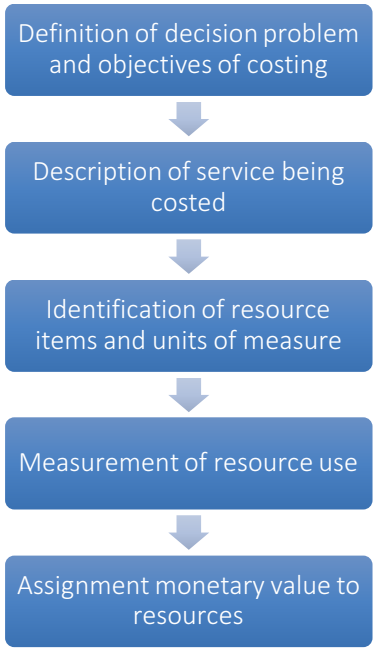

Figure 3.5 - Process of Costing, adapted from Mogyorosy & Smith, 2005

A primary costing study was undertaken to enable the calculation of costs to be included in the economic model and to ensure that costs are reflective of current service delivery models. Drummond and colleagues identify a scale of precision to healthcare costing from average daily cost to micro-costing (Drummond et al., 2005), whilst Brouwer and colleagues recognise that in practice the majority of economic evaluations use a combination of approaches from this scale (Brouwer et al., 2001).

A pragmatic approach was adopted to costing the OCCP and comparator pathways, in line with the type of economic evaluation for stage II of technology development identified by Sculpher and colleagues. They recognise that in respect of the identification of costs there is greater access to "individual patient data on the costs and outcomes of the new technology" however that "stage II estimates of cost-effectiveness are unlikely to be definitive" (Sculpher et al., 1997:27). Further information on the detail of the costing methods used is contained in section 7.2.

Careful consideration was given to the selection of the economic model used to assess the likely costs and benefits of a fully integrated online testing and treatment service for chlamydia. The use of static versus dynamic models in considering the cost-effectiveness of interventions for infectious diseases is widely debated. A literature review was undertaken, and the result presented in section 7.4.4. This identified that, for evaluating the cost-effectiveness of chlamydia testing and treatment, both types of models are in us: static models (Althaus et al., 2014, Hislop et al., 2010, Turner et al., 2011, Turner et al., 2014) and dynamic models (Adams et al., 2007, Looker et al., 2015, Low et al., 2007). A separate published literature review exploring the cost-effectiveness of chlamydia screening identified that six out of ten studies used dynamic models and four used static models (ECDC, 2014).

Economic models can be broadly categorised as illustrated in figure 3.6. Brennan and colleagues argue that it is the responsibility of the model developer rather than the policy maker to determine the type of model being used, and "advocate the use of simple models that still accurately reflect disease progression and health care delivery to the extent needed by a given decision problem" (Brennan et al., 2006:1307).

This view is supported by Pitman and colleagues who note that dynamic models are important when the intervention impacts on the transmission of the disease, however they suggest that static models are acceptable where "their projections suggest that an intervention is cost-effective and dynamic effects would further enhance this" (Pitman et al., 2012:829), proposing the use of dynamic modelling to supplement static models which indicate borderline cost-effectiveness (ibid.).

			A	B	C	D
			Cohort/ aggregate level / counts		Individual Level	
			Expected value, continuous state, deterministic	Markovian, discrete state, stochastic	Markovian, discrete state, individuals	Non-Markovian, discrete state, individuals
1	No Interaction Allowed	Untimed	Decision tree rollback	Simulated decision tree	Individual sampling model (ISM); simulated patient-level decision tree (SPLDT)	
2		Timed	Markov model (evaluated deterministically)	Simulated Markov model	ISM: Simulated patient level Markov model (SPLMM) (variations as in quadrant below for patient level models with interaction)	
3	Interaction Allowed	Discrete Time	System dynamics (finite difference equations)	Discrete time Markov chain model	Discrete time individual event history model	Discrete individual simulation
4		Continuous Time	System dynamics (ordinary differential equations)	Continuous time Markov chain model	Continuous time individual event history model	Discrete event simulation

Figure 3.6 - Taxonomy of Model Structures, Source: Brennan et al., 2006:1297

Roberts concluded that in order to avoid misleading results, transmission dynamic models should be used to evaluate the cost-effectiveness of chlamydia screening programmes. To illustrate the difference between the static and dynamic modelling approaches, Roberts created three models, two static and one transmission dynamic to compare the cost-effectiveness of non-selective proactive screening, with no organised screening (Roberts, 2008). This identified base case results from the three models as follows: Static 1 - £8,474 per major outcome averted (MOA), Static 2 - £13,344 per MOA and Dynamic - £19,300 per MOA. Roberts explains the difference in results as being attributable to the comparator option not being the same – the static models had a comparator of no screening, whereas the dynamic model assumed a background level of opportunistic screening, plus the difference in approach to the application of discounting between static and dynamic models (ibid.).

Whilst it is recognised that dynamic models are superior to static models for modelling infectious diseases (Barton et al., 2004, Roberts, 2008) it also recognised that they are more complex, costlier and time consuming to develop. In the present study, a decision analytic model was selected for the following reasons:

- This is an early stage evaluation of a new technology and therefore the objective is to demonstrate the likely impact on costs and outcomes to inform future research and development
- Data for parametrising a model about the new technology are somewhat limited, with no data on self-testing (Stages 1 and 2 in pathway E, figure 2.1) and some initial exploratory study results and costings for OCCP (Stages 3 to 5 in pathway E, figure 2.1).

- It is not yet known how the availability of self-tests may influence sexual behaviours, risk taking and testing patterns, all of which would be material considerations within a dynamic model to inform parameters such as partner change rate.

In terms of quantifying benefits, Drummond and colleagues categorise outcomes into intermediate and final, with intermediate outcomes representing a measure which indicates a change in health outcome e.g. improvement in CD4 count (a measure of how well the immune system is working in patients with HIV) versus a final outcome e.g. survival or health related quality of life (Drummond et al., 2015). Process measures may also be an important consideration in the evaluation of a complex intervention (Moore et al., 2015). Process measures typically include aspects in relation to "service organisation, delivery and use" (Bowling, 2009:11). Use, i.e. testing and treatment uptake, are key parameters impacting both costs and outcomes within the economic evaluation undertaken in this thesis.

The outcome metric for economic evaluation preferred by NICE is the quality adjusted life year (QALY) as it a common unit of measure which enables comparison of outcomes between different health care interventions (Gray et al., 2011). QALYs are calculated by multiplying the health state outcome (represented on a scale of 1 for perfect health to 0 which is death) by the time spent in that state (Drummond et al., 2015). The difference in QALYs for an intervention is shown in figure 3.7:

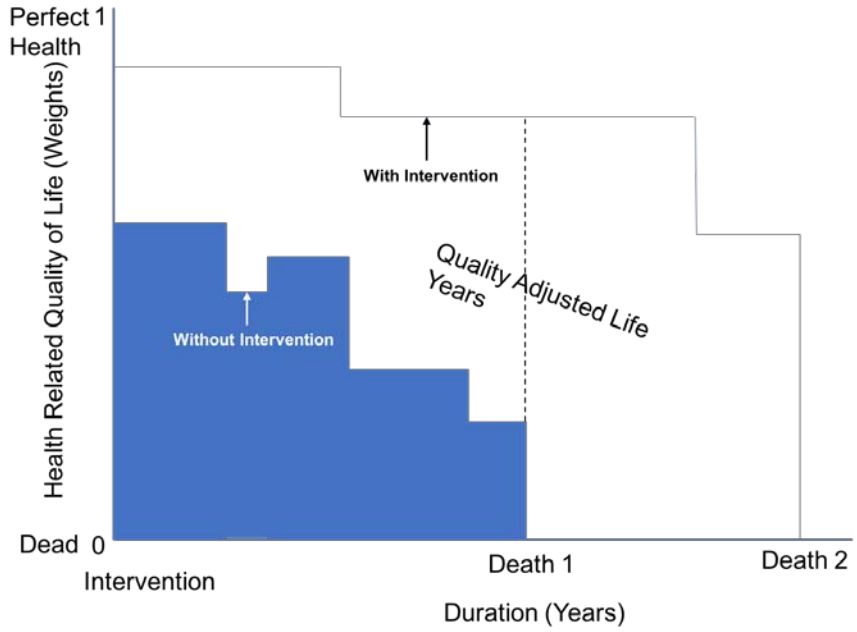

Figure 3.7 - QALYs gained from an intervention, taken from Drummond et al., 2015:9.

Whilst it is recognised that QALYs are the outcome metric preferred by NICE, the ECDC argue that use of cost per QALY to measure the effectiveness of chlamydia screening is inappropriate because "undiagnosed asymptomatic chlamydia infections do not affect quality of life. The complications of chlamydia are also rarely fatal. The impact of chlamydia is therefore mainly through morbidity and decreases in quality of life resulting from PID and its sequelae" (ECDC, 2014:44).

A recent systematic review of economic evaluations has examined the use of QALYs and valuation of health states associated with chlamydia and the consequences of untreated infection (Jackson et al., 2014). Of the 19 included studies in this review, 11 studies cited the same source of QALY information from an Institute of Medicine study (ibid.). The reviewers highlight methodological concerns associated with valuing short-term health states for chlamydia as those highlighted by the ECDC and also draw out the issue of delayed (long term) complications of the disease occurring, in many cases, years after the initial infection (ibid.).

Jackson and colleagues argue that further research is required to enable more robust health state measurements to enable economic evaluations for chlamydia screening to be conducted in accordance with NICE standards (ibid.). Owing to the concerns highlighted by the ECDC and Jackson and colleagues, a proxy measure of health outcomes (health complications of untreated chlamydia) has been selected over QALYs as the outcome measure in this analysis. The health complications included in the economic model are:

- Pelvic Inflammatory Disease (PID)
- Infertility
- Ectopic Pregnancy
- Pre-term Rupture of Membranes (PROM)
- Neonatal Conjunctivitis
- Neonatal Pneumonia
- Epididymitis.

Figure 3.8 outlines the research methods chosen to parametrise the economic model, recognising the early stage of technology development. Given the absence of a self-test, a hypothetical scenario was used in order to demonstrate the impact of variance on test performance characteristics.

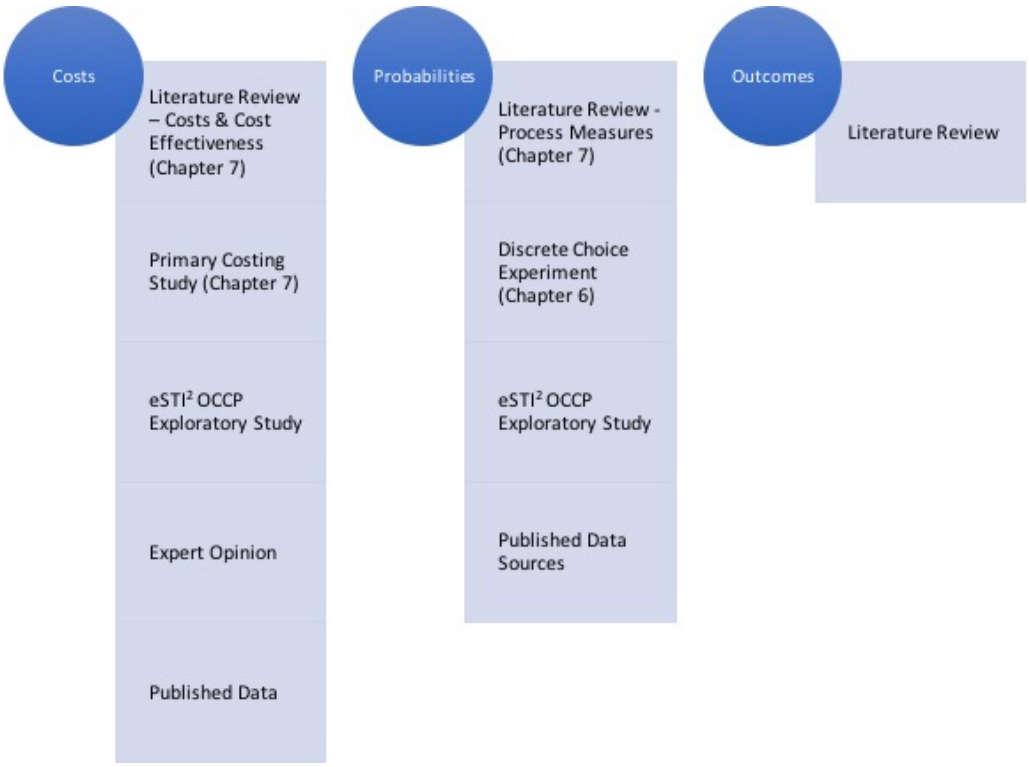

Figure 3.8 - Research methods used to parameterise the model

A key feature of early economic evaluation is that it is indicative rather than definitive and significant parameter uncertainty is one of the main reasons for this (Sculpher et al., 1997). The aim of early economic evaluation is to provide an indication of the likely costs and benefits of a new technology and to identify areas for further consideration for technology developers. Therefore, sensitivity analysis has been undertaken as part of both the costing study presented in Chapter 7 and the economic modelling in Chapter 8. Reference was made to both the NICE MTEP methods guide (NICE, 2011) and the ISPOR good research practices for parameter estimation and uncertainty (Briggs et al., 2012) to inform the selection of the methods. One way sensitivity analysis was selected as the method so that the impact of varying individual parameters can be seen on the key outcomes to provide insight into the impact on both costs and outcomes. It was concluded that an understanding of the impact at an individual level would be most beneficial in future technology development.

Detailed information on the methods for the development and parametrisation of the model, and validity checks are included in section 8.2.

3.6 Methods for the Measurement of Healthcare Preferences

STI testing services are not subject to gatekeeping by referral from a clinician, they are therefore directly dependent on individuals' preferences. Probabilities of uptake are key parameters within the economic model and early insight into the attributes which are most influential in determining whether individuals would use a new STI self-test and treatment pathway will therefore be helpful in informing product development and the assumptions used in any later economic modelling. It is also recognised that "aligning health care policy with patient preferences could improve the effectiveness of health care interventions by improving adoption of, satisfaction with, and adherence to clinical treatments or public health programmes" (Bridges et al., 2011:404).

There are a wide variety of approaches that might have been used in preference elicitation in this study. A summary of the techniques used in healthcare identified in a systematic review (Ryan et al., 2001) is provided in table 3.6.

Quantitative Methods	Qualitative Methods
• Ranking Techniques • Simple ranking exercise • Qualitative discriminative process • Conjoint analysis ranking exercises • Rating Techniques • Rating scales (visual analogue scales) • Rating scales within conjoint analysis studies • Schedule for the evaluation of individual quality of life • Likert scale • Semantic differential technique • Guttman scales • Satisfaction surveys • SERVQUAL (service quality) • Choice based techniques • Simple choice exercise • Random paired scenarios • Conjoint analysis choice-based questions (discrete or graded) • Analytic hierarchy process • Standard gamble • Time trade off • Person trade off • Willingness to pay • Measure of value • Allocation of points	• Individual approaches • One to one interviews • Dyadic interview • Case study analysis • Delphi technique • Complaints procedures • Group based approaches • Focus groups • Concept mapping • Citizens' juries • Consensus panels • Public meetings • Nominal group technique

Table 3.6 - Summary of Methods Identified for Eliciting Patient Preferences in Healthcare. Source: Ryan et al., 2001

HTA recognises that patient preferences must be taken into consideration, reflecting the importance of acceptability of a new technology (Drummond et al., 2013). From the list of methods identified for capturing patient preferences Ryan and colleagues concluded that there is no single method which is best, but highlight that "conjoint-based methods (including ranking, rating and choice-based), willingness to pay, standard gamble and time trade-off of the quantitative techniques and one-to-one interviews, focus groups, Delphi technique and citizens' juries of the qualitative methods are recommended" (Ryan et al., 2001:iv).

More recently, Drummond and colleagues also point to the lack of methodological consensus on how to incorporate patients' views into the HTA process and called for the development of methods in this area (Drummond et al., 2013). They propose the use of systematic reviews of primary and secondary evidence on patients' perspectives.

Choice based methods are recognised as being acceptable to participants "on the basis that they present them with the types of decisions they face on a daily basis. It is this argument that has led to the choice based technique being preferred over ranking and rating approaches" (Ryan et al., 2001:31). However, the same review's conclusions note that that choice-based methods require further exploration, rather than give an explicit recommendation for their use as a quantitative preference elicitation method. Since the publication of this review fifteen years ago there has been a significant increase in the use of this method within healthcare from 34 studies between 1990 and 2000, to 179 between 2009 and 2012 (Clark et al., 2014).

Conjoint analysis based methods have been used widely in a range of non-health areas including marketing and transport (Hall et al., 2004) and product development (Bridges, 2003), with Hall and colleagues highlighting their benefit when evaluating "new products and programs where market information is not available" (Hall et al., 2004:1026). Bridges and colleagues (2011) highlight two categories of stated preference methods:

- methods using ranking, rating or choice designs which include conjoint analysis, discrete choice experiments or stated-choice methods, and
- methods which use the "direct elicitation of monetary values of an intervention" (Bridges et al., 2011:404) which include contingent valuation and willingness to pay methods.

Focusing specifically on the definitions of the first category, Carson and Louviere (2011) point to inconsistency in the use of language with terms such as conjoint analysis and DCE used interchangeably (Carson and Louviere, 2011). They define the origins of conjoint analysis within the marketing field, defining it as a term used to "refer to the specific method of eliciting preferences derived from conjoint measurement" (Carson and Louviere, 2011:5). In contrast they highlight that DCEs have a theoretical basis in random utility theory and define them as " a general preference elicitation approach that asks agents to make choice[s] between two or more discrete alternatives where at least one attribute of the alternative is systematically varied across respondents in such a way that information related to preference parameters of an indirect utility function can be inferred" (ibid. p5).

Bridges points to a number of advantages of using stated preference methods in health care evaluation over cost-effectiveness analysis. These include the ability of stated preference methods to focus on all relevant aspects of an intervention rather than a single outcome measure, their ability to incorporate patient/ consumer preferences at the centre of the analysis, and the ability to compare interventions and identify improvements (Bridges, 2003). It is also recognised that these methods can add value where population uptake is key to achieving cost-effectiveness through offering insight into attributes which the population value other than health outcomes, e.g. convenience, waiting times (Hall et al., 2004, Ryan, 2004).

Bryan and Dolan (2004) consider some of the disadvantages to the use of DCEs in particular in evaluating health care, they identify a range of limitations including:

- 'normative issues' – the majority of published DCEs sample service users rather than the general population which limits their transferability when considering uptake of services,
- the 'cognitive burden' placed on respondents and the number of discrete choices included in the survey may lead to respondents not completing the survey accurately
- the generalizability of results (Bryan and Dolan, 2004).

The use of conjoint analysis choice based questions (table 3.6) in the form of a DCE approach was selected for this thesis over other preference methods because it is a technique that allows insight into:

- the relative importance of a range of attributes that make up a product and/ or service
- which attributes people may be willing to trade
- the uptake of a particular product or service (Lancsar and Louviere, 2008).

This method was recognised as being particularly valuable within the context of eHTA as it has the potential to:

- inform the design of the new technology
- offer insight into characteristics which will inform pathway design
- provide evidence on acceptability and potential uptake.

3.6.1 Methods for Conducting the Discrete Choice Experiment

A DCE is a prospective mixed methods study that comprises a number of stages; the stages identified by Ryan and colleagues have been overlaid by the research methods to be used in figure 3.9:

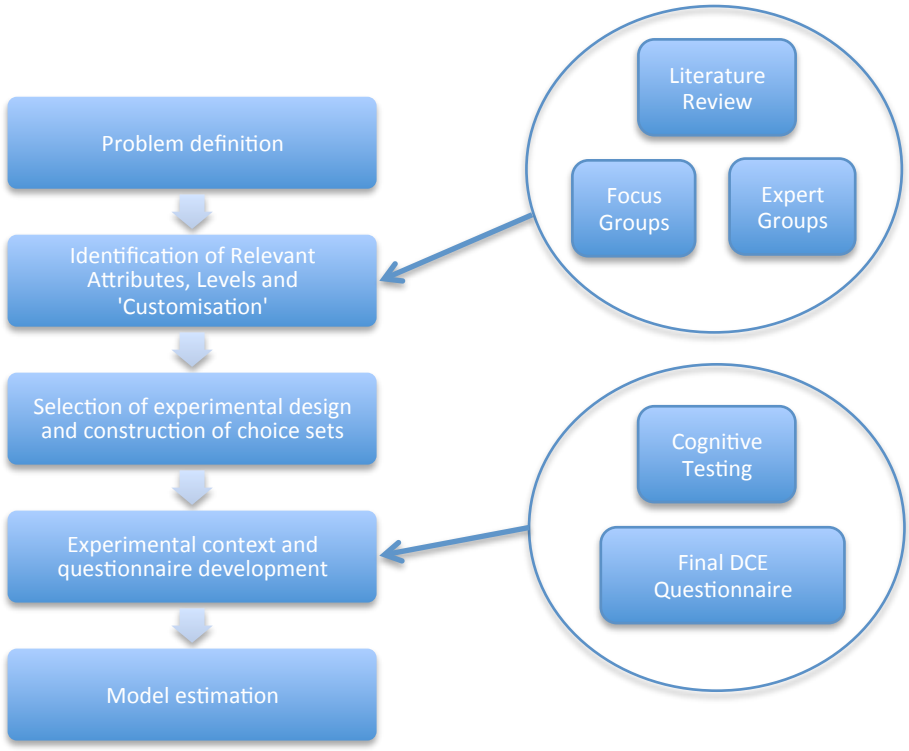

Figure 3.9 - Stages in Conducting a Discrete Choice Experiment (Ryan et al., 2008)

This approach is defined as an exploratory sequential mixed methods design by Cresswell who highlights it as an approach which is helpful for the development of a quantitative survey instrument based on the findings of a qualitative stage (Creswell, 2014). This is summarised in figure 3.10:

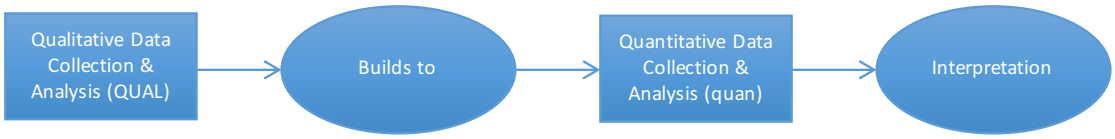

Figure 3.10 - Exploratory sequential mixed methods design (Cresswell, 2014:22)

The use of a qualitative data collection stage for the selection of attributes and levels has varied over time with a recent literature review of the use of DCEs in healthcare identifying that qualitative methods were used to inform attribute selection in 69% of studies between 2001 and 2008 and 51% of studies between 2009 and 2012, and level selection of 33% and 40% respectively (Clark et al., 2014).

The literature review did not indicate how included studies identified attributes and levels if not using qualitative methods, however, Bridges and colleagues have listed potential methods as "literature review and other evidence on the impact of the disease and the nature of the health technology being assessed. Consultation with clinical experts, qualitative research or other preliminary studies can provide the basis for identifying the full set of attributes (and even possible attribute levels) that characterize the profiles to be evaluated" (Bridges et al., 2011:405-406). The focus in this list is largely on clinical experts, whereas for the asymptomatic pathway redesign being considered in this thesis, the young person's views are essential.

Qualitative research with young people was identified to be essential in the identification of attributes and levels in this research with a second stage review with experts because of the number of potential attributes and levels that could be included. In considering which qualitative research method was most appropriate to inform the selection of attributes for the DCE, a number of factors were taken into consideration as described below. These included the topic (STI testing), the target age group for participation in the research (young people aged 16-24) and how the outputs will be used, for example to inform the optimisation of service delivery pathways.

Whilst both Bridges and colleagues (2011) and Lancsar & Louviere (2008) acknowledge the contribution of qualitative research to the identification and selection of attributes and levels, Ryan and colleagues (2008) single out focus groups as being particularly helpful in DCEs to inform the identification of attributes, attribute levels and interaction effects (Ryan et al., 2008). Coast and colleagues explored the use of two methods in attribute development (interviews or focus groups) and concluded that there is a need for further research to explore whether the method chosen leads to a variance in attributes selected (Coast et al., 2012).

Qualitative research methods literature was explored to understand whether there were any notable benefits in the use of a particular method in undertaking research with the selected age range. However, there were no findings from this which supported the selection of one method over another based on age. Kirk noted in her literature review exploring methodological issues in conducting qualitative research with young people and children that there are more similarities in undertaking qualitative research with young people compared with adults than there are differences. The main differences relate to psychological development - the differing perspectives on the world, cognitive development and ability to communicate, and adaptation of methods to enable participation (Kirk, 2007).

In undertaking qualitative research with young people Millward notes that there has been considerable interest in the use of focus groups to elicit views from this population, stating that the interest is "mainly derived from the potential of focus groups to generate discussion about semi-public issues, content that might otherwise be difficult to obtain from children and young people in one-to-one interviews" (Millward, 2012:435).

In considering whether focus groups were the most appropriate method to use for DCE attribute development it was noted that focus groups are commonly used as a first step in general questionnaire development (Millward, 2012), for exploring attitudes relating to a specific topic (Barbour and Kitzinger, 1999), and for exploring views and experience of health services (Kitzinger, 1995).

The benefits that focus groups offer to the research over and above other qualitative methods are that the group situation can enable people to "explore and clarify their views" (Kitzinger, 1995:299), reflect on the views of others and consider their own position further (Finch et al., 2014), and the method unsurprisingly encourages dialogue which questions, as it is highly unlikely that everyone in the group will be in agreement initially (Barbour, 2007). However, a key risk is that the focus group may stifle individuals who disagree with the majority (Kitzinger, 1995).

Methodological texts also suggest that focus groups are recognised as a method which is particularly effective when tackling sensitive issues (Bowling, 2009), with specific reference made to research in the area of sexual health and HIV (Barbour, 2007, Barbour and Kitzinger, 1999). Therefore, taking into consideration the benefits outlined above, focus groups were selected over interviews as the method of qualitative research to support attribute development and selection.

To inform the selection of attributes and levels for the DCE, three separate but linked pieces of research were undertaken, summarised in table 3.7:

Research	Objectives
Literature Reviews	• To identify a long list of attributes • To identify potential levels • To identify gaps in knowledge • To inform the development of the focus groups
Focus Groups	• To identify which factors are important to young people in choosing to use sexual health services • To gain insight into the reasons for the importance of factors • Rational for trading between factors and prioritisation • How participants articulate views on factors
Expert Groups	• To add current NHS/ Policy perspective to inform the final selection of attributes and levels for the DCE alongside the findings from the focus groups • To test the selection of attributes against the best practice requirements identified by Bridges and colleagues (Bridges et al., 2011)

Table 3.7 - Summary of research undertaken to inform the selection of attributes and levels

From the initial background knowledge acquired through the mapping of clinical pathways it was apparent that the breadth of potential attributes which could be included in the DCE far outweighed what is was feasible to include in the DCE taking into account both product and service characteristics. Therefore, considerable importance was placed on the selection of attributes and levels to minimise the risks associated, principally respondents making assumptions about missing attributes (Klojgaard et al., 2012, Lancsar and Louviere, 2008).

The detailed methods for the DCE questionnaire design stage are outlined further in section 6.2. A generic main effects questionnaire design was chosen to understand the component attributes of importance to young people. The questionnaire was constructed using a pairwise choice with opt out to reduce the risk of social desirability bias, using full profiles, that is, including all attributes being considered in the study. Cognitive testing was used to pilot the questionnaire to evaluate the cognitive burden of questionnaire completion and whether respondents could comprehend the breadth of attributes when making choices.

3.7 Ethical Considerations

Ethical approval was granted by the Biomedical & Scientific Research Ethics Committee (BSREC) at the University of Warwick for the studies as indicated in table 3.8:

Study	BSREC Reference	Approval Letter
Patient Preferences for Sexually Transmitted Infection Testing & Treatment – Pilot Phase	REGO-2014-694	Appendix 2
Patient Preferences for Sexually Transmitted Infection Testing & Treatment – Final DCE	REGO-2015-1647	Appendix 3
Identification of pathways, costs and performance monitoring data for Chlamydia Testing and Treatment	REGO-2015-1497	Appendix 4

Table 3.8 - Summary of Ethical Approval

3.7.1.1 Consent

Informed consent was recorded for all focus group, cognitive interview and costing study participants. A statement of consent was included at the start of the online DCE questionnaire which made it clear that by continuing participants were consenting for their response to be used as outlined in the participant information leaflet.

Specific consideration was given to the issues regarding consent of 16-18 year olds. The guidance provided by the MRC states that for research covered by the clinical trials regulations a minor is defined as someone under the age of 16 and "where common law applies – all situations not covered by the Regulations – the law states that the age of majority is 18. Whilst not considered to have fully reached adulthood, young people between the age of 16 and 18 are presumed to be competent to give consent" (Medical Research Council, 2007:23).

Young people are considered competent to consent to have sex at age 16 and they can choose to access NHS STI testing and treatment services (including ordering postal chlamydia testing kits from the NCSP) without their parents being informed or requiring their consent. As the research involved talking to 16-18 year olds about their preferences for STI testing and treatment services, and within the context of the MRC guidance, parental consent was not required in addition to participant consent for this study.

3.7.1.2 Sensitivity of Topic

For participants in the focus groups and cognitive testing interviews the only potential risk identified was that participants may regard the topic of STI testing and treatment to be embarrassing or sensitive. Participants were made aware of the topic in advance and that discussion centred on the attributes of testing and treatment services, and what may influence their decision to use them. Participants were also reminded during the introduction to the focus group and interviews that if they were not comfortable with answering a question or taking part in the discussion they did not have to. For participants completing the DCE online the same issue exists however they had the option to drop out of the questionnaire at any point prior to completion.

For participants in the costing study, no sensitive issues were identified as their participation related directly to their job role.

3.7.1.3 Expenses & Payments

Participants in the focus groups and cognitive interviews were offered a £10 shopping voucher in recognition of their time commitment. Participants in the final online DCE were offered reimbursement in accordance with the predefined criteria used by Youthsight of 1 point (equivalent to £1) for completion of a survey of up to 20 minutes in length. Points are then exchanged for Amazon Vouchers. No participant in the costing study was offered reimbursement as their participation was linked directly to their job role.

3.8 Summary

This chapter has introduced HTA, specifically eHTA as the overarching framework for the consideration of the research questions explored in this thesis. Whilst the methods used for undertaking HTA at the end of the technology development process (at the point of market access) are well defined and utilised by agencies such as NICE, published research on the methods and application of eHTA are limited, particularly in respect of telemedicine, eHealth and mHealth. It is important to recognise that the research presented addresses some, but not all aspects of eHTA, with the safety and clinical effectiveness of the OCCP and self-test being developed being assessed by other researchers within the eSTI^2 consortium.

The technology being considered in this thesis has been situated in the appropriate stage of technology development to inform the selection of methods to address the research questions. This chapter has provided an overview of the key considerations for the selection of the methods to answer the research questions within the context of eHTA. As outlined, both the DCE and economic evaluation are comprised of a number of component pieces of research which are presented in the following chapters, each chapter includes a detailed outline of the methods selected and the justification of the choices made. The next chapter, Chapter 4, introduces the two literature reviews undertaken to understand patient preferences for and acceptability of STI testing and treatment and to identify the 'long list' of attributes for consideration in the DCE.

CHAPTER 4 – LITERATURE REVIEWS TO INFORM SELECTION OF POTENTIAL ATTRIBUTES FOR THE DCE

4.1 Introduction

This chapter describes two separate literature reviews that were undertaken to inform the DCE study design and the selection of a 'long list' of potential attributes for the DCE:

i. a review of the use of stated preference studies for STI testing and treatment services adopting a systematic review approach
ii. a scoping review of other studies exploring the preferences and acceptability of STI testing and treatment services.

The literature reviews had different objectives. The objective of the first literature review was *to identify and appraise published studies in order to inform the methods used for the design and development of the proposed DCE and to explore evidence on which attributes influence patient and clinician preferences for the testing and treatment of STIs.* The desired outcomes would both contribute to a 'long list' of potential attributes and inform the development of the planned DCE. The objective of the second literature review was *to identify which factors influence individuals' decisions to access testing and treatment services for STIs.* The desired outcome of this literature review was solely to contribute to the 'long list' of potential attributes for the DCE.

Consideration was given to the methods for undertaking the literature reviews using Grant & Booth's typology of reviews (Grant and Booth, 2009). For the first review a systematic review approach was adopted, which conformed to the methods outlined in the Cochrane Handbook for the Systematic Review of Interventions (Higgins and Green, 2011) where possible.

For the second review a scoping review was undertaken. This is defined by Grant and Booth as "a preliminary assessment of the potential size and scope of available research literature. It aims to identify the nature and extent of research evidence (usually including ongoing research)" (Grant and Booth, 2009:101). A weakness of this approach is that it does not include an assessment of the quality of studies which may lead to bias, however since the aim of this second review was to add to the 'long list' of potential attributes, the quality of a study was less relevant. The overall aim was to produce a comprehensive list of potential attributes to form the framework for focus group discussion.

Adapting the approach in the Cochrane Handbook and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (Moher et al., 2009), review processes consisted of the following stages:

- defining the review question and formulating the criteria for including studies;
- literature searches;
- selection of studies to include in the review;
- data extraction;
- quality assessment;
- synthesis.

Quality assessment was undertaken for the first review only, recognising the aim was to learn from the application of stated preference methods to inform the design and development of the planned DCE as well as the creation of a 'long list' of potential attributes.

4.2 Literature Review I: Use of Stated Preference Studies for STI Testing & Treatment Services

As outlined in the previous section the objective of the first literature review was to identify and appraise published studies exploring which attributes influence patient and clinician preferences for the testing and treatment of STIs.

4.2.1 Methods Adopted for the Literature Review

The inclusion criteria were identified as:

- any stated preference study within the scope of STI testing and treatment services. This included but was not limited to products (e.g. tests, drugs, condoms, microbicides) and services (e.g. screening and screening programmes, and service providers e.g. GPs, CaSH clinics and GUM clinics);
- There was no date limiter, with all published studies included to end of 2014.

Exclusion criteria included studies:

- not related to humans;
- not published in English;
- from outside of the OECD High Income Countries (see Appendix 5 for list);
- not related to the diagnosis or treatment of STIs (e.g. vaccinations).

The review was registered in the International Register of Prospective Systematic Reviews (PROSPERO), reference CRD42014014862.

4.2.2 Search Strategy

The following databases were searched on 28 April 2014 to identify studies published to the end of 2013, the saved database searches were re-run in April 2015 to search for any studies meeting the inclusion criteria published between 1 January and 31 December 2014 and no further studies were identified:

- Medline
- EMBASE
- CINAHL
- Web of Science
- Econlit
- PsycINFO
- Cochrane Library (incorporating the following databases):
    - Cochrane Database of Systematic Reviews
    - Cochrane Central Register of Controlled Trials
    - Cochrane Methodology Register
    - Database of Abstracts of Reviews of Effects
    - Health Technology Assessment Database
    - NHS Economic Evaluation Database

The key search terms and their abbreviated database entry (where applicable) are summarised in table 4.1. Search terms were identified from books and published research outlining methods for DCEs (Ryan et al., 2008, McIntosh et al., 2010, Lancsar and Louviere, 2008, Bridges et al., 2011, Clark et al., 2014). Searches were structured to meet the search requirements of the respective database and terms expanded where the facility existed to do this.

Category	Search Terms Entered
STIs	Sexually transmitted STI STD Sexual health
	AND
Stated Preference Studies	Stated preference Stated choice Discrete choice DCE Conjoint analysis Contingent valuation Willingness to pay WTP Willingness to accept WTA Visual analogue scale VAS Rating scale Magnitude estimation Standard gamble Time trade off TTO Person trade off PTO Functional measurement Paired comparison (pairwise comparison*) Pairwise choice (pairwise choice*) Conjoint measurement Part worth utilities (part worth util*) Conjoint studies (conjoint stud*) Conjoint choice Choice exercise (choice exercise*) Random paired scenario (scenario*) Payment card Allocation of point (allocation of point*) Analytic hierarchy process Measure of value

Table 4.1 - Search Terms

An example search strategy from Medline is included in Appendix 6. Individual STIs (e.g. Chlamydia) were not included in the search strategy, as it was determined that attributes and levels could potentially be identified from any STI/ sexual health product or service.

The results were imported into Endnote x6 for Mac and duplicates removed. Abstracts were reviewed and articles excluded for the reasons identified in section 4.3.1.

4.2.3 Search Results

The initial search identified 4,657 records and 312 duplicates were removed in Endnote leaving 4,345 for initial review. The titles and abstracts were reviewed for each exclusion criterion in turn; leaving a total of 10 studies that met the inclusion criteria. Bibliographies of the included papers were then reviewed and this identified a further two studies which met the inclusion criteria (Phillips et al., 2002, Ryan and Watson, 2009), taking the total number of studies included to 12. A second reviewer confirmed that all studies met the inclusion criteria. The search results are illustrated in the PRISMA flowchart, figure 4.1.

The reasons for the exclusion of studies at the screening stage are summarised in table 4.2:

Reasons for Exclusion at Screening Stage	Number of Studies Excluded
Studies that do not relate to STI testing and treatment services	3,532
Not a stated preference study	785
Not a high income study	6
Studies not related to mainstream service delivery e.g. vaccination	12

Table 4.2 - Reasons for the Exclusion of Papers at Screening Stage

Figure 4.1 - PRISMA Flowchart of Included Studies

4.2.4 Data Extraction

The data extraction form was designed to take into account the review question. It captured key study characteristics and the quality requirements. Recognising the benefits of electronic data capture "Use of an electronic form has the added advantage of being able to combine data extraction and data entry into one step, and to facilitate data analysis and the production of results tables for the final report" (Centre for Reviews and Dissemination, 2009:Section 1.3.3). The data extraction form is included in Appendix 7. These forms were reproduced in Excel for Mac 2011 to facilitate data analysis. Data extraction was checked by a second reviewer.

4.2.5 Key Findings

In total 12 studies met the inclusion criteria; six focusing on STI testing (general STI testing, HIV testing and chlamydia screening), four exploring preferences for STI treatment (HIV and genital herpes) and two exploring preferences for an intervention to prevent the transmission of STIs (microbicide development). These are summarised within the context of a sexual health pathway in figure 4.2. Of studies included: 11 focused on the patient/service user perspective and one explored a clinician perspective; eight focused on existing services/ treatments and four explored the introduction of new options (POCT, Self-testing for HIV and microbicide use for STI prevention).

Two of the studies contained a strong methods perspective, that is the primary focus of the publication was on exploring the method, rather than reporting the study findings themselves – adaptive conjoint analysis (Beusterien et al., 2005), and comparison of payment card contingent valuation and DCE (Ryan and Watson 2009).

A summary of the studies included in the review is presented in table 4.3.

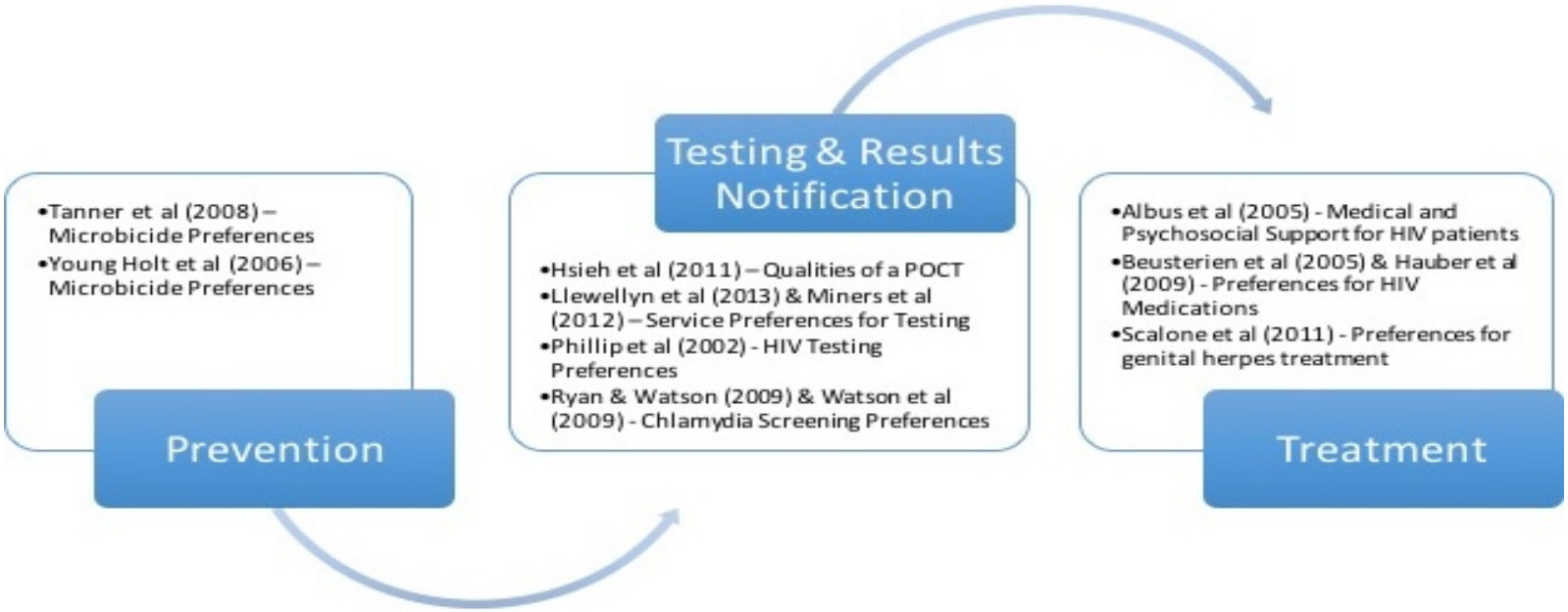

Figure 4.2 - Included Studies Grouped by Stages in the Sexual Health Pathway.

Ref	Author	Study Focus	Type of Stated Preference Study	Year of study	Country of study	Sample Size
1	Albus et al. (2005)	Preferences for medical and psychosocial support in HIV infected patients	Conjoint Analysis	2001	Germany	163
2	Beusterien et al. (2005)	Patient preferences for HIV medications	Adaptive Conjoint Analysis	Not stated	USA	35
3	Hauber et al. (2009)	Preferences of Antiretroviral-Naïve African Americans for HIV Treatments	Conjoint Analysis	2006-2007	USA	153
4	Hsieh et al. (2011)	Qualities of a POCT for clinicians and others offering STI testing	Discrete Choice Experiment	2009	Worldwide (majority USA)	218
5	Llewellyn et al. (2013)	Service preferences for testing for STIs	Discrete Choice Experiment	2011	England	233
6	Miners et al. (2012)	User preferences for STI testing services	Discrete Choice Experiment	2010	England	3358
7	Phillips et al. (2002)	User preferences for HIV test methods	Conjoint Analysis	1999-2000	USA	365
8	Ryan and Watson (2009)	Women's preferences for chlamydia screening	Payment Card Contingent Valuation Discrete Choice Experiment	Not stated	Scotland	174
9	Scalone et al. (2011)	Patient preferences for genital herpes treatment	Discrete Choice Experiment	2004	UK & USA	154
10	Tanner et al. (2008)	Vaginal Microbicide Preferences	Conjoint Analysis	Not stated	USA	405
11	Watson et al., (2009)	Experience factors in the provision of chlamydia screening	Discrete Choice Experiment	2002	Scotland	126
12	Young Holt et al. (2006)	Microbicide preference among young women in California	Conjoint analysis	Not stated	USA	321

Table 4.3- Summary of Included Studies

Of the included studies, five were reported as DCEs, six as conjoint analysis (one of which was adaptive conjoint analysis) and one as a comparison between a DCE and payment card contingent valuation. There were significant differences in the sample sizes included – from 35 (reported as an adaptive conjoint analysis feasibility study) to 3,358 (large scale DCE across a number of service delivery sites).

Table 4.4 summarises the range of attributes and demographic sub-groups included. Not unsurprisingly given the focus of the studies there is a spread in the type of characteristics considered:

- Service Characteristics (Albus et al., 2005, Llewellyn et al., 2013, Miners et al., 2012)
- Product Characteristics (Hsieh et al., 2011, Young Holt et al., 2006, Tanner et al., 2008)
- Mix of Service & Product Characteristics (Phillips et al., 2002, Ryan and Watson 2009, Watson et al., 2009)
- Medication Characteristics and Side Effects (Beusterien et al., 2005, Scalone et al., 2011, Hauber et al., 2009).

It should be noted that of the studies included, Llewellyn et al (2013) used the questionnaire developed by Miners et al (2012) in their study (and acknowledge this), and the attributes and levels used in the Ryan and Watson (2009) and Watson et al (2009) studies were the same, although there was no explicit statement in either paper acknowledging this.

There has been some debate over the use of a 'cost' attribute to assess willingness-to-pay (WTP) in conjoint analysis, particularly in countries like the UK where healthcare is free at the point of delivery. Clark and colleagues noted that the "proportion of DCE studies using either a 'per WTP' or a 'monetary welfare measure' as their primary outcome has fallen" (Clark et al 2014:13) and suggested that this could be due to concerns regarding the use of DCEs to obtain WTP and the presentation of attributes within DCEs (ibid.).

Of the four identified studies undertaken solely in the UK, two included a cost attribute (Ryan and Watson, 2009, Watson et al., 2009) and two studies excluded a cost attribute (Llewellyn et al., 2013, Miners et al., 2012). Miners and colleagues highlighted that a cost attribute was excluded because "strong objections to the notion of 'cost' in the context of STI testing were raised in most of the focus groups" (Miners et al., 2012:511). Ryan and Watson's paper compared the use of payment card contingent valuation and a DCE to elicit WTP data from the same sample, whilst Watson and colleagues paper included cost of screening as one of the five attributes in their DCE. Neither reported concerns over inclusion of a cost attribute within their papers, however neither indicated that they had included patients or public in the selection of the attributes for inclusion within the studies.

Ref	Author	Study Focus	Attributes	Demographics
1	Albus et al., (2005)	Preferences for medical and psychosocial support in HIV infected patients	• Information • Counselling • Consultation Hours	• Age • Sex • Ethnicity • Time since diagnosis • Treatment in this clinic • Matriculation standard • Currently employed • Receiving pension • Income less than €1,000
2	Beusterien et al., (2005)	Patient preferences for HIV medications	• Moderate to severe diarrhoea • Moderate to severe nausea • Moderate to severe vomiting • Moderate to severe rash • Moderate to severe jaundice • Moderate to severe dizziness • Moderate to severe depression • Moderate to severe sleep problems • Virologic failure • Increasing cholesterol • Chance of developing resistance • Regimen convenience	• Ethnicity • Employment status

Ref	Author	Study Focus	Attributes	Demographics
3	Hauber et al. (2009)	Patient Preference for HIV treatments	• Chance that medicine doesn't work • Chance of allergic reaction • Chance of bone damage • Chance of kidney damage • What happens if you have bone or kidney damage	• Age • Gender • Highest Education Level • Employment Status • Years of HIV Positive Status
4	Hsieh et al., (2011)	Qualities of a POCT for clinicians and others offering STI testing	• Sensitivity • Specificity • Cost • Time	• Gender • Country/Continent of Residence • Profession • Location of Practices • Primary Practice • Medicaid/ Medicare Provider
5	Llewellyn et al., (2013)	Service preferences for testing for STIs	• Time to appointment • Results waiting time • Comprehensiveness of results • Staff knowledge • Comprehensiveness of testing • Results reporting method	• Age • Sex • Ethnicity • Sexual Preference • Believes currently has STI symptoms • Previous STI test • Previous treatment for STI • Previously tested at GP surgery • Previously testing at STI/GUM clinic

Ref	Author	Study Focus	Attributes	Demographics
6	Miners et al., (2012)	User preferences for STI testing services	• Time to appointment • Results waiting time • Comprehensiveness of results • Staff knowledge • Comprehensiveness of testing • Results reporting method	• Age • Sex • Ethnicity • Sexual Preference • Highest Qualification • Employment Status • Number of Previous STI Tests • Number of Previous STI Treatments • Believes currently has STI Symptoms
7	Phillips et al., (2002)	User preferences for HIV test methods	• Location • Price • Ease of Collection • Timeliness/Accuracy • Privacy/ Anonymity • Counselling	• Age • Gender • Ethnicity • Sexual Preference • Education • Income
8	Ryan and Watson, (2009)	Women's preferences for chlamydia screening	• Place of Screening • Type of Screening Test • Cost to you of Screening Test • Risk of Pelvic Inflammatory Disease (PID) if you have Chlamydia and are not treated • Support of trained health care advisor when you receive results	• Age • Employment • Education • Income • Relationship Status

Ref	Author	Study Focus	Attributes	Demographics
9	Scalone et al., (2011)	Patient preferences for genital herpes (GH) treatment	• Chance of a GH recurrence in the next 12 months • Chance of transmission of GH virus to an uninfected partner in the next 12 months • Chance of becoming infected with HIV in the next 12 months • Number of tablets taken daily • Number of tablets taken daily during each recurrence • Cost of GH treatment per month	• Gender • Age • Marital Status • Relationship Status • Income • Age at Diagnosis of GH • Number of outbreaks in previous 12 months • Number of subjects according to the number of outbreaks • Time from the last outbreak to heal • Level of pain/discomfort during outbreaks • No of GP/STI clinic visits in last 12 months • Current medication for GH • Satisfaction with treatment
10	Tanner et al., (2008)	Microbicide Preferences among adolescent women	• Contraception • Timing • Side Effects • Target STIs	• Age • Race • Ethnicity • Sexual Intercourse • Hormonal Contraceptive Use
11	Watson et al., (2009)	Experience factors in the provision of chlamydia screening	• Place of Screening • Type of Screening • Cost to you of Screening • Risk of PID • Support of a Trained Health Care Advisor	• Age • Employment • Education • Income • Method of Contraception • Relationship Status • Smoker • Previously diagnosed with Chlamydia

Ref	Author	Study Focus	Attributes	Demographics
12	Young Holt et al (2006)	Microbicide preference among young women in California	• Spectrum of disease protection • Method of distribution • Efficacy levels • Applicator type • Leakage/ messiness • Duration of activity	• Race/ ethnicity • Age • Relationship status • Ever had an STI • Concern about STIs • Pregnancy • Concern about pregnancy • Type of sex practiced with steady partner • Type of sex practiced with casual partner • Condom use

Table 4.4 - Attributes and Demographics Analysed

4.2.6 Quality Assessment

No reporting checklist was identified which was suitable for assessing the reporting of stated preference studies. Literature reviews of DCEs in health economics (Ryan and Gerard, 2003, de Bekker-Grob et al., 2010, Clark et al., 2014) centred primarily on three key aspects: experimental design, estimation procedures and validity because of the ongoing methodological debate in these areas (de Bekker-Grob et al., 2010). These literature reviews were helpful in understanding advances in the methodology and utilisation of DCEs over time but did not offer insight into the quality or recommend good practice for reporting of studies.

The International Society for Pharmacoeconomics and Outcomes Research (ISPOR), recognised the benefit that a "structure to guide the development, analysis and publication of conjoint analyses in health care studies" would offer, established a task force to explore good research practices for conjoint analysis (Bridges et al., 2011). The intent of the checklist produced was to offer a view on 'good research practice' rather than define best practice (ibid.). A pilot evaluation of the ISPOR checklist on articles published between 1980 and 2008 found that studies generally reported less than suggested by the checklist, in particular in the areas of methods to generate experimental design and reporting design properties (Marshall et al., 2009).

In considering how to assess the quality of articles included in the present review, reference was made to the EQUATOR network 'Library of Health Research Reporting' (EQUATOR Network, 2014) and the Critical Appraisal Skills Programme (CASP) (Critical Appraisal Skills Programme, 2014). The ISPOR checklist was selected as it is equally applicable to DCEs and other types of conjoint analysis (Bridges et al., 2011).

It should be noted that all of the studies included were commenced prior to the publication of the final ISPOR checklist and that the lack of reporting in an article does not mean that the criterion was not adequately considered in the study design and development. In utilising the checklist consideration was given to the 30 sub-questions under the 10 items on the checklist because of the breadth of good practice cited under each heading on the checklist, to identify whether there were common themes at a lower level. A full breakdown of the checklist is included in Appendix 8 and summarised at an aggregated level in the following sections.

4.2.6.1 Research Question

All of the studies set out a research question although this was not always presented in the form of a testable hypothesis. However, in all cases the question enabled a hypothesis to be deduced.

The context of the study was clear and the study perspective described (for example patient or healthcare professionals' perspective) in 11 of the 12 included studies. However, the rationale for using conjoint analysis was not always clearly identified (three out of twelve), in particular why it was preferred to other methods which could be used (Bridges et al., 2011).

4.2.6.2 Attributes & Tasks

The majority of the studies (nine out of twelve) provided some information on the approach used to identify the attributes included in the study. Methods used included literature review, gathering information on the product e.g. side effects, and consultation with clinical experts.

Of the studies involving patients/ service users, seven (Albus et al., 2005, Hauber et al., 2009, Llewellyn et al., 2013, Miners et al., 2012, Phillips et al., 2002, Tanner et al., 2008, Young Holt et al, 2006) undertook qualitative research with users to inform the development of their questionnaire. It should be noted that one study (Llewellyn et al., 2013) included no information on attribute selection and construction of tasks, instead making reference to the study published by Miners and colleagues (2012).

Of the twelve studies included, seven centred on 'real' attributes and five introduced a hypothetical element, for example, extended service offer (Albus et al., 2005,), POCT parameters (Hsieh et al., 2011), HIV self-testing (Phillips et al., 2002) and product characteristics of microbicides (Tanner et al., 2008, Young Holt et al., 2006).

The numbers of attributes and levels varied significantly across the studies. The range in the number of attributes was from three to twelve, with five of the studies having six attributes. The number of levels within each attribute again varied significantly with the range being two to nine. Good practice (Bridges et al., 2011) suggests that the inclusion and exclusion of attributes and levels should be clearly justified. In the studies reviewed there was only one (Miners et al., 2012) which provided examples of the selection and de-selection of attributes. In respect of the selection of levels some evidence was provided in nine studies but no study provided a clear justification of the level selection for all included attributes.

4.2.6.3 *Construction of Tasks, Experimental Design & Preference Elicitation*

These sections of the checklist cover aspects that centre on the justification of the experimental design including whether a full or partial profile was selected, the number of profiles included in each task, whether an opt-out option was considered and whether the number of conjoint tasks included was appropriate (Bridges et al., 2011). It also includes whether appropriate information was given to explain the questionnaire and whether an appropriate elicitation format was used.

In all studies limited information was provided on these topic areas with only, for example, three studies (Albus et al., 2005, Phillips et al., 2002, Young Holt et al., 2006) providing a full justification of the number of attributes and profiles in each task and only three studies (Llewellyn et al., 2013, Ryan and Watson, 2009, Scalone et al., 2011) discussing the use of an opt out or status quo question.

The reporting of consideration of alternative experimental designs was limited with only two studies (Miners et al., 2012, Ryan and Watson, 2009) discussing this issue in detail, although a further four made a brief reference to experimental design. Half of the studies reported consideration of the number of conjoint tasks to be included in the study. Of the DCEs included, all used paired choice with two providing an opt out to take account of a participant preferring a no test/ no treatment option (Llewellyn et al., 2013, Scalone et al., 2011). The number of choice questions ranged from nine to 24. Of the twelve studies reviewed:

- three used rating scales (Albus et al., 2005, Tanner et al., 2008, Young Holt et al., 2006),
- one included questions based on ranking, rating and choice (Beusterien et al., 2005),

- four used paired choices (Hauber et al., 2009, Hsieh et al., 2011, Miners et al., 2012, Phillips et al., 2002),
- two used paired choices and an opt out (Llewellyn et al., 2013, Scalone et al., 2011),
- two used binary choice (yes/no) for each individual profile (Ryan and Watson 2009, Watson et al., 2009).

In respect of preference elicitation very little information was provided in articles on the motivation and explanation, elicitation format or qualifying questions, and where reported this only covered part of the conjoint analysis checklist sub-question. As a result it is difficult to comment on how studies addressed these aspects. In section 10, the checklist points to the option available (in most cases) of publishing the questionnaire on the journal's website as supplementary data (Bridges et al., 2011); of the studies included only three (Hsieh et al., 2011, Scalone et al., 2011, Watson et al., 2009) published supplementary information.

4.2.6.4 Instrument Design & Data Collection

All studies recognised the importance of eliciting socio-demographic and health status information to enable exploration of preferences based on these criteria. All of the studies (where the study included both sexes) except one (Beusterien et al., 2005) considered gender a key demographic. Of the five studies which explored STI testing with service users (Llewellyn et al., 2013, Miners et al., 2012, Phillips et al., 2002, Ryan and Watson, 2009, Watson et al., 2009) two studies considered previous STI testing history (Llewellyn et al., 2013, Miners et al., 2012) and three studies sought information on the sexual preference of participants (Llewellyn et al., 2013, Miners et al., 2012, Phillips et al., 2002).

With respect to the provision of contextual information to respondents to ensure that they have a consistent understanding of the attributes and levels within the tasks, very limited information was provided, with only one study (Young Holt et al., 2006) providing sufficient information about this within the article to enable assessment against the checklist criteria. Similarly, limited information was provided on the level of burden of the data collection instrument with the published information predominantly relating to the incentive for participating in the study (Beusterien et al., 2005, Llewellyn et al., 2013, Young Holt et al., 2006).

In terms of data collection, five of the studies reported some justification of the sampling strategy and inclusion criteria. Sample size is perhaps the element of the sample recruitment strategy which is worthiest of discussion within this section. All papers reported their sample size, and the majority commented on the basis for including/ excluding returned questionnaires e.g. incomplete responses (Albus et al., 2005, Hsieh et al., 2011, Phillips et al., 2002), illogical responses (Miners et al., 2012, Beusterien et al., 2005), identical ratings for all profiles (Young Holt et al., 2006). As noted in table 4.3 there are significant variations for sample size in the studies included in the literature review – from 35 to 3,348.

The good practice checklist cites Orme's recommendation of "sample sizes of at least 300 with a minimum of 200 respondents per group for subgroup analysis" (Bridges et al., 2011:409). On this basis it can be seen that only a third of the studies exceed the suggested minimum number of responses (Miners et al., 2012, Phillips et al., 2002, Tanner et al., 2008 and Young Holt et al., 2006).

In addition, it should be noted that all studies used convenience samples, and of the nine studies based on patients/ service users only two studies incorporated people without the condition or those who were not current service/ product users (Llewellyn et al., 2013, Young Holt et al., 2006).

In terms of questionnaire completion, there were varied methods used across the 12 studies with one study using face-to-face completion with trained interviewer (Young Holt et al., 2006), five completion of paper based questionnaires in waiting rooms (Albus et al., 2005, Miners et al., 2012, Phillips et al., 2002, Ryan and Watson, 2009, Watson et al., 2009), three were on line questionnaires (Hsieh et al., 2011, Llewellyn et al., 2013, Scalone et al., 2011), two used a computer guided self-interview technique (Beusterien et al., 2005, Tanner et al., 2008) and one did not state the method used (Hauber et al., 2009).

With regards to ethical considerations all studies bar two (Scalone et al., 2001, Tanner et al., 2008) included information on ethics approval within the published article.

4.2.6.5 Statistical Analyses, Results & Conclusions

Across the 12 studies, all reported the characteristics of the respondent sample, although consideration of the generalizability of results was more limited. Due to the methods used to recruit participants, none had information on people who had declined to complete the survey making comparisons between responders and non-responders impossible.

Half of the studies used respondent characteristics to inform sub-group analysis but only two reported the results of statistical tests undertaken on the sample population. In one, logistic regression was used to assess whether there were any statistically significant differences between demographic groups which predicted completeness of response (Miners et al., 2012) and in the other a Kruskal-Wallis test was used to assess significant differences between the "characteristics of the full and reduced samples" (Ryan and Watson, 2009:394).

The majority of studies (nine out of twelve) reported the checks undertaken on validity, with more than one check being used in some cases. Checks included:

- Face validity of the results/ Consistency with theoretical predictions (Beusterien et al., 2005, Llewellyn et al., 2013, Miners et al., 2012, Phillips et al., 2002, Scalone et al., 2011),
- Percentage of questions answered illogically/ consistency check (Beusterien et al., 2005, Llewellyn et al., 2013, Miners et al., 2012, Phillips et al 2002, Ryan and Watson, 2009, Young Holt et al., 2006),
- Selection of same option/ monotone response (Albus et al., 2005, Ryan and Watson, 2009,
- Tests for dominance (Hauber et al., 2009, Llewellyn et al., 2013, Miners et al., 2012.

Only one study explored external validity (Watson et al., 2009) by offering the participants an option of screening reflecting one of the profiles in the study immediately following questionnaire completion. This was achieved by the respondent completing the questionnaire in the waiting room of a family planning clinic.

Just over half of the studies reported whether effects and dummy coding was used for variables, with three using effects coding (Phillips et al., 2002, Ryan and Watson, 2009, Watson et al., 2009), four using dummy coding (Hsieh et al., 2011, Llewellyn et al., 2013, Miners et al., 2012, Young Holt et al., 2006) and five (Albus et al., 2005, Beusterien et al., 2005, Hauber et al., 2009, Scalone et al., 2011, Tanner et al., 2008) not reporting the method used.

Again, there was variation in the models used to analyse the data and the primary outcome measures reported, as summarised in table 4.5:

Ref	Author	Questionnaire Type	Model Used	Primary Reported Outcome(s)
1	Albus et al., (2005)	Rating Scale	Not stated – Sawtooth Software (CVA system) used for analysis	Relative healthcare preferences derived from conjoint analysis. No unit of measure indicated
2	Beusterien et al., (2005)	Paired Choice	Not stated – ACA Version 3.5 (Sawtooth Software Inc.) generated utility values for all levels included	Median "percent importance" estimates for each attribute
3	Hauber et al. (2009)	Paired Choice	Multivariate, random parameters, or mixed logit regression	Importance ratings for each attribute (including 95% CI) Maximum acceptable risk (including 95% CI)
4	Hsieh et al., (2011)	Paired Choice	Conditional Logistic Regression	Odds Ratio and $p<0.05$ for each attribute level
5	Llewellyn et al., (2013)	Paired Choice with Opt Out	Multinomial Logistic Regression	Odds Ratio, 95% CI and p-value for each attribute level

Ref	Author	Questionnaire Type	Model Used	Primary Reported Outcome(s)
6	Miners et al., (2012)	Paired Choice	Random Effects Logistic Regression	Unadjusted Odds Ratios, 95% CI and p-value for each attribute level Adjusted Odds Ratios, 95% CI and p-value for each attribute level (adjusted for age, sex, CASH, MSM, no of previous tests, symptoms of STIs, education and employment status) Odds Ratios for sub-group preferences with 95% CI
7	Phillips et al., (2002)	Paired Choice	Random Effects Probit Model	Coefficient, standard error, WTP compared to baseline with 95% CI for each attribute level
8	Ryan and Watson, (2009)	Binary Choice	Logit Model	Coefficient and t-statistic for basic model and income interaction model, maximum WTP estimates with 95% CI for each attribute level
9	Scalone et al., (2011)	Paired Choice with Opt Out (no treatment) option	Mixed Logit Model	Estimated means and standard deviation of coefficients Maximum willingness to pay mean and 95% CI Predicted uptake rates for treatment options in different cost scenarios
10	Tanner et al., (2008)	Rating Scale	Not stated	Part worth utility scores for each attribute level
11	Watson et al., (2009)	Binary Choice	Logit Model	Coefficient and t-statistic for basic model and interaction model, mean WTP estimates with 95% CI for each attribute level Predicted test uptake
12	Young Holt et al (2006)	Rating Scale	Logistic Regression	Median relative importance of attributes Median of attribute level's part worths

Table 4.5 - Summary of model used and primary reported outcomes

Although Bridges and colleagues provide a brief summary of models that can be used in conjoint analysis (Bridges et al., 2011), they do not offer an opinion on a preferred model for different scenarios. This has been considered in more detail by Ryan and colleagues who outlined the strengths and weaknesses of different model types and suggested binary probit or logit models for binary choice and paired choice questionnaires, and multinomial logit model for scenarios involving three or more choices (Ryan et al., 2008). For the studies included in the present review, where a model was specified in the article these were consistent with the categorisation outlined by Ryan and colleagues.

The majority of studies reported their findings within the context of the original research question, although four (Albus et al., 2005, Beusterien et al., 2005, Hsieh et al., 2011, Tanner et al., 2008) either did not clearly report their results or the statistical uncertainty associated with results. All studies presented conclusions supported by evidence and the majority situated these within the context of existing published findings. All discussed the limitations of their study and all but two (Beusterien et al, 2005, Hauber et al., 2009) discussed the generalizability of findings.

4.2.6.6 Study Presentation

The final area of the checklist relates to the presentation of the study (Bridges et al., 2011). In all cases the papers clearly articulated a perceived need for the study, identifying gaps in the literature that had been addressed. In terms of the presentation of the study, there was a notable difference in the construction of articles between journals, in particular those published in health economic journals (Beusterien et al., 2005, Ryan and Watson, 2009, Watson et al., 2009) compared with specialist clinical journals, however the summary of the assessment against the checklist (Appendix 8) did not identify any pattern of reporting specific to health economic journals compared with specialist clinical journals. The checklist identifies the need to ensure the definition of terms used. This was something not consistently seen across the articles.

The checklist also highlights that "a reviewer cannot provide a meaningful review of a conjoint analysis paper without seeing the format and framing of the questions that generated the data." (Bridges et al., 2011:411). As highlighted only two studies (Hsieh et al., 2011, Scalone et al., 2011) included the questionnaire as a supplementary document on the journal's website, although Watson and colleagues (2009) stated that it could be provided on request.

Finally all papers provided some information on the impact of the research either in terms of the methodology or the significance of the results for service providers, technology manufacturers or policy makers.

4.2.7 Discussion

The review highlighted a number of considerations for the design of the DCE including:

- Selection of attributes and levels – a priority for the DCE being developed is that it considers the impact of new technology on existing service pathways, that is, action can be taken as a result of the findings to improve services;
- Sampling strategy – to reflect the point highlighted above, to realise the economic and public health benefit, a primary consideration needs to be understanding the needs of people who have not previously accessed services as well as the selection of subgroups for analysis;
- Background information and explanation of tasks – this was not an area which was easy to assess in the reviewed studies owing to the lack of information in articles, however, to minimise the risks associated with assumptions regarding potential attributes not included in the DCE is one which is essential.

The studies reviewed varied in the degree to which they were applicable to all stages of a model of fully remote online provision (Pathway E, figure 2.1). Of the studies identified, only one considered self-testing (Phillips et al., 2002). This is self-testing for HIV, an incurable STI, which may in turn be an attribute which influences whether people would want to self-test. This was undertaken at a time when self-testing for HIV was in development but before the technology was FDA approved, and before the time that smartphones were available as a possible solution for this type of testing. One study considered POCT (Hsieh et al., 2011), however the sample for this study was clinicians who currently undertake STI testing rather than the population being tested.

Two studies considered self-sampling for chlamydia screening (Ryan and Watson, 2009, Watson et al., 2009) both of which found that screening at home "decreases the general preference for screening" (Watson et al., 2009:622). Two studies (Llewellyn et al., 2013, Miners et al., 2012) explored preference for testing within the context of current STI services but did not incorporate hypothetical scenarios based on new technology e.g. POCT, self-testing or treatment availability via an eHealth/mHealth solution.

Whilst Phillips and colleagues identified that "instant home tests would become at least as preferred as the baseline scenario (public clinic tests) if they were highly accurate and cost $10" (Phillips et al., 2002:1697), no studies were identified which explored preferences for testing for STIs incorporating the potential new options offered by rapid POCT in community locations or self-testing.

Within the studies identified which considered STI testing, only one study (Llewellyn et al., 2013) sought to include non-service users within the sample, all other samples were drawn from people known to have the condition, current service users or attendees for other linked services e.g. family planning. This is significant within the context of new technology development for asymptomatic pathways where the economic and public health benefit may, in part, be delivered through increasing the uptake of testing and treatment.

Applying the ISPOR good practice checklist as a mechanism for assessing the quality within the reporting of the conjoint analysis provided a useful framework for exploring the strengths and weaknesses of the studies. One of the main limitations in the majority of published studies was a lack of justification provided for the chosen options e.g. attribute selection, choice of experimental design, mode of administration. This was also reflected in a review of conjoint analysis studies for colorectal cancer screening which applied the ISPOR checklist as a framework for reviewing the studies (Ghanouni et al., 2013).

Finally, the findings from the literature review also point to a number of potential attributes (table 4.4) to be included in the 'long list' for the discrete choice experiment including test performance characteristics, time to result, range of STIs tested for and location of services. These were explored in more detail in the second literature review.

4.3 Literature Review II – Preferences and Acceptability of Main Stream Sexual Health Services

As outlined in section 4.1 the objective of the second literature review was ***to*** *identify which factors might influence individuals' decisions to access testing and treatment services for STIs.* The desired outcome of this literature review was to contribute to the 'long list' of potential attributes for the DCE.

The rationale for broadening the literature search is in recognition of the broader preference elicitation techniques identified by Ryan and colleagues (2001), which could inform the identification of attributes including research published on acceptability, patient choice, uptake and access.

Attributes can be defined as the product specific features that are evaluated in the DCE and levels are the variation within each attribute (Szeinbach et al., 2011). Attributes are comprised of a number of levels (e.g. for time to result, the levels would be a selection of times to result). Levels must be "plausible, actionable and capable of being traded" (Ryan, 1999:445). Ryan and colleagues note that there are no specific rules for determining the attributes and levels included in a DCE, defining a good experiment as one "that has a sufficiently rich set of attributes and choice contexts, together with enough variation in the attribute levels necessary to produce meaningful behavioural responses in the context of the strategies under study" (Ryan et al 2008:17).

Other key issues relating to attribute development have been identified by Coast and colleagues as:

- "What should attributes look like?
- Should qualitative methods be used and to what extent?

- What are the advantages and disadvantages of different qualitative methods for developing attributes?
- How should attribute development be reported?" (Coast et al., 2012:732).

4.3.1 Methods Adopted for Literature Review

Learning was applied from the review of stated preference studies in determining the inclusion and exclusion criteria for this second scoping review. In particular, in the selection of studies involving product characteristics for new technologies.

The inclusion criteria were identified as:

- any study which indicates individuals' preferences or acceptability of STI testing and/ or treatment services
- studies published between Jan 2004-Sept 2014
- conference abstracts, where the abstract enabled the extraction of information on study focus and key findings.

The date range for the literature review was selected to limit the volume of results identified to the last 10 years. This recognised the fact that the previous literature review only identified one stated preference study which met the inclusion criteria pre-2004, and that none of the studies identified included relevant new technologies e.g. internet or smartphone based services.

The exclusion criteria were identified as any study:

- not published in English
- not related to humans
- not related to preferences for sexual health services
- from outside of the OECD High Income Country List (see Appendix 5)

- not related directly to testing and/ or treatment provision e.g. drug characteristics, health promotion interventions
- not offering a perspective provided by service user/ potential service user e.g. clinician
- focused on non-mainstream service provision e.g. STI testing in A&E, dedicated service provision for specific high risk groups such as men recently released from prison, sex workers, injecting drug users.

4.3.2 Search Strategy

The key search terms included were:

- Sexually transmitted infections, sexually transmitted diseases, sexual health
- Test, treatment, service
- Patient preference, acceptability, choice, uptake, access.

Individual STIs (e.g. Chlamydia) were not included in the search strategy, as it was determined that attributes and levels could potentially be identified from any STI/ sexual health product or service. The Medline search strategy is included in Appendix 9.

A smaller selection of databases was chosen for this scoping review, with the databases selected being those which had generated a high return rate of relevant articles in the first literature review and encompassing journals where research relating to nursing, AHPs and psychology is published.

The three databases searched were:

- Medline
- CINAHL
- PsycINFO.

4.3.3 Search Results

The initial search identified 8,057 records and 1,057 duplicates were removed in Endnote leaving 6,959 for initial review. The titles and abstracts were reviewed by a single reviewer for each exclusion criterion in turn; leaving a total of 135 studies for full text review. Three papers were excluded at this stage, resulting in 132 studies identified. Given the volume of papers meeting the inclusion criteria a bibliographic search of included studies was not undertaken. The search results are presented in the PRISMA flowchart in figure 4.3. Reasons for the exclusion of papers at the screening stage are outlined in table 4.6, and at the full text review stage in table 4.7.

Reasons for Exclusion at Screening Stage	Number of Studies Excluded
Studies that do not relate to preferences for sexual health services	6,664
Not OECD High Income Country	67
Studies that do not relate directly to testing and treatment provision e.g. drug properties, side effects, health promotion interventions	42
Studies that do not focus on mainstream service provision e.g. STI testing in EMU or A&E, or are dedicated service provision for specific high risk groups e.g. men recently released from prison, sex workers, injecting drug users	51

Table 4.6 - Reasons for the exclusion of papers at screening stage

Study Excluded	Reason
Menon-Johansson et al (2010)	Study based on activity data not patient preference
O'Dowd (2011)	Commentary on a report published by the Health Protection Agency
Sonnenberg et al (2013)	Study does not include data on preferences for accessing testing and treatment services

Table 4.7 - Reasons for exclusion of studies at full text review stage

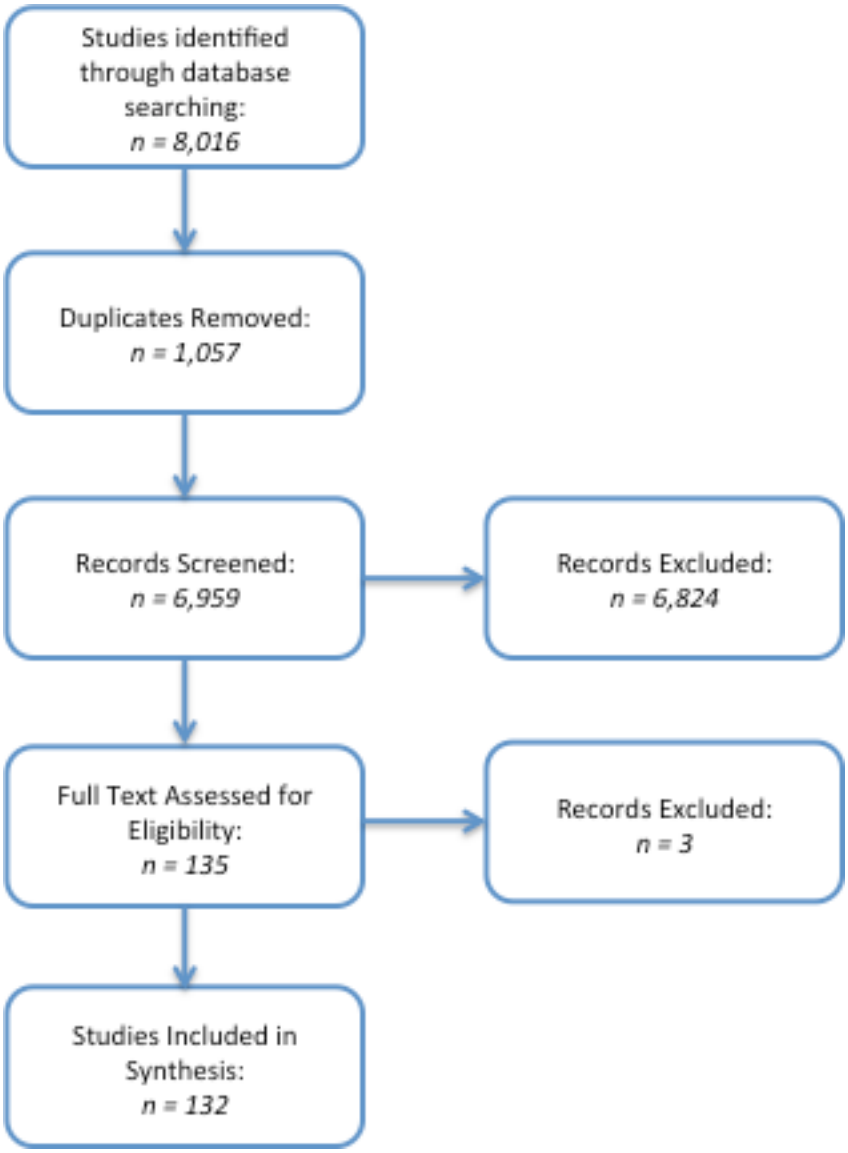

Figure 4.3 - PRISMA Flowchart of Included Studies

4.3.4 Data Extraction

As the purpose of the review was to identify potential attributes for inclusion in the DCE the data extraction was limited to the following characteristics:

- study focus
- study type
- population studied
- country of study
- key findings.

Studies were then categorised based on the following parameters:

- Parameter 1 - population studied – service users, general population, unclear,
- Parameter 2 - whether the study considered HIV only,
- Parameter 3 - whether the study focused on product or service characteristics, or values beliefs, perceptions and behaviours,
- Parameter 4 - whether the study focused on a single product or characteristic or whether it encompassed more than one aspect of the pathway in figure 2.1,
- Parameter 5 - whether the study introduced a "new technology". New technologies were defined to include: the internet, point-of-care testing and self-testing.

All studies, which focused on product or service characteristics, were examined in greater detail. Data was extracted on the primary focus of the study. Studies were categorised as:

- self-sampling
- self-sampling (home-testing pathways)
- HIV POCT/ rapid testing
- POCT – Other STIs
- HIV self-testing
- other STI self-testing
- test location
- test collection point
- results notification
- consultation method
- treatment location
- partner notification
- clinic models
- multiple aspects of pathway
- other.

Finally, using the information extracted, potential attributes or factors informing attributes were drawn out from the literature.

The data was extracted into an Excel spreadsheet for analysis. A review of the quality of the papers, examination of bias and data analysis was not undertaken as the outcome of this would not change the identification of potential attributes for inclusion in the DCE. A summary of all included studies which shows: study focus, key findings, potential attributes and factors informing attributes identified is included in Appendix 10.

4.3.5 Key Findings

Of 132 papers reviewed, broadly equal numbers (57 versus 62) were classified under Parameter 1 as service users and general population respectively (43% versus 47%). In 13 studies the population studied was unclear; in a number of cases these were systematic reviews which included studies from both classifications. Thirty-one studies (23%) considered HIV only (Parameter 2).

The majority of studies identified, 93 (70%), focused on product and service characteristics, whilst 30% focused on values, beliefs, perceptions and behaviours relating to accessing sexual health services, but did not report specifically on product or service characteristics. Four of the 93 focused on product and service characteristics also included some findings in respect of values, beliefs, perceptions and behaviours (Parameter 3).

Of the 93 studies reporting on acceptability or preferences for product or service characteristics, 77 studies (83%) focused on a single product or service characteristic e.g. self-sampling, location of test, results notification, and 31 studies (33%) introduced a new technology (Parameter 4).

The primary focus of studies was categorised as shown in table 4.8:

Study Category	Number of Studies	Percentage of Studies
Self-Sampling	7	8%
Self-Sampling (home-testing pathways)	10	11%
HIV POCT/ Rapid Testing	9	10%
POCT other STIs	3	3%
HIV Self-Testing	6	6%
Other STI Self-Testing	3	3%
Test Location	17	18%
Test Collection Point	1	1%
Results Notification	6	6%
Consultation Method	2	2%
Treatment Location	1	1%
Partner Notification	7	8%
Clinic Models	7	8%
Multiple Aspects of Pathway	13	14%
Other	2	2%

Table 4.8 - Categorisation of Study Focus of Included Studies (note percentages do not sum to 100% due to rounding)

Whilst a number of the studies identified include the introduction of a new technology (Parameter 5) including use of some aspects of eHealth and mHealth these did not reflect all the core features of a fully integrated online pathway, particularly online treatment consultation. In respect of remote self-testing, reviewing the 22 studies which considered sampling methods for STIs other than HIV, analysis identified that self-testing/ self-sampling was acceptable, see table 4.9.

Analysis of the 93 studies which focused on product or services characteristics shows that 17 (18%) focused on some aspect of self-sampling, 12 (13%) on POCT and nine (10%) on aspects of self-testing, see table 4.8. A total of 17 (18%) focused on test location. Only six (6%) focused on the next stage in the pathway shown in figure 2.1, results notification. The consultation method and treatment location were considered in three (3%) of studies and partner notification in seven (7%), other studies focused on clinical models or multiple aspects of the pathway in figure 2.1.

Study Findings	Studies
Studies finding self-testing acceptable	Huppert et al. (2012) Krause et al. (2013)
Studies finding self-sampling acceptable	Brown et al. (2010) Doshi et al. (2008) Fernando and Thompson (2013) Fielder et al. (2013) Gaydos et al. (2006) Gotz et al. (2005) Graseck et al. (2010b) Graseck et al. (2010a) Hoebe et al. (2006) Iles and Oakeshott (2005) Jones et al. (2013) Llewellyn et al. (2009) Rosenberger et al. (2011) Saunders et al. (2012) Shih et al. (2011) Soni and White (2011) Wayal et al. (2009)
Studies finding clinician collected samples preferred	Anhang et al. (2005) Basta et al. (2009) Roth et al. (2011)

Table 4.9 - Summary of Published Studies on the Acceptability of Self-Sampling and Self-Testing

Table 4.10 provides more details on the findings of studies considering a preference for testing location. These included the studies considering preferences for where the test itself was undertaken. In respect of where the test kit was collected from, one study explored this for young men, identifying that the preferred collection points were GUM, GP practice and pharmacy (Saunders et al 2012) which reflects the findings of Wayal and colleagues who found that MSM preferred testing kits to be made available in medical locations rather than 'social' locations (Wayal et al., 2011). Other studies have established the acceptability of internet-based access to testing i.e. ordering the test online (Gaydos et al., 2006, Gilbert et al., 2013, Kwan et al., 2012, Shoveller et al., 2009, Tomnay et al., 2014), and pharmacy collection (Gudka et al., 2013).

Location of Test	Studies Indicating Preference for Location
Home (self-test)	Greacen et al. (2013)
Home (self-sample)	Gotz et al (2005) Graseck et al (2010) Graseck et al (2010) Greenland et al. (2011) Holloway et al. (2011) Llewellyn et al (2009) Novak and Karlsson (2006) Shih et al (2011) Skala et al. (2012) Tebb et al. (2004)
Home (outreach service)	Sena et al. (2010)
GP practice	Gray et al. (2009) Hogan et al. (2010) Iles and Oakeshott (2005) Prost et al. (2009)
General Clinic/ Health Centre	Ashby et al. (2012)
Sexual Health/ GUM Clinic	Hambly and Luzzi (2006) Jerome et al. (2009) Koester et al. (2013) Llewellyn et al. (2012) Saadatmand et al. (2012)
Abortion Clinic	Norman et al. (2004)
Outreach/ Community Based	Friedman and Bloodgood (2013) Hawk (2013) Hengel et al. (2013) Lambert et al. (2005) Marrazzo and Scholes (2008) Prost et al. (2007) Sena et al (2010) Vaughan et al. (2010)

Table 4.10 – Studies indicating a preference for testing location

Balfe and colleagues identified four reasons why young people choose to test for STIs - a 'transitional moment' e.g. ceasing to use condoms with a partner, unprotected sex, symptoms of an STI, or if a requirement of their employment (Balfe and Brugha, 2009). Equally, many of the included studies which focused on values, beliefs, perceptions and behaviours identified key reasons why people do not choose to test for STIs. Table 4.11 provides a breakdown of these reasons.

Preferences for Service Types and Reasons for Not Testing	Studies Citing
Embarrassment	Booth et al. (2013) Chaudhary et al. (2008) Ingram and Salmon (2010) Leston et al. (2012) Lindberg et al. (2006) Mills et al. (2006) Samangaya (2007)
Access & Convenience	Ashby et al. (2012) Friedman and Bloodgood (2013) Greacen et al. (2013) Gudka et al. (2013) Hitchings et al. (2009) Hottes et al. (2012) Oliver de Visser and O'Neill (2013) Prost et al. (2009) Shoveller et al. (2012) Vaughan et al. (2010)
Stigma	Balfe and Brugha (2009) Balfe and Brugha (2011) Fakoya et al. (2008) Glasman et al. (2010) Lindberg et al. (2006) Mills et al. (2006) Pavlin et al. (2006) Rose et al. (2008) Wong et al. (2012)

Preferences for Service Types and Reasons for Not Testing	Studies Citing
Privacy/ Confidentiality/ Anonymity Concerns	Anhang et al. (2005) Baraitser et al. (2011) Balfe et al. (2010) Balfe and Brugha (2011) Fernando and Clutterbuck (2008) Friedman and Bloodgood (2013) Greacen et al. (2013) Hambly and Luzzi (2006) Hitchings et al. (2009) Hottes et al. (2012) Ingram and Salmon (2007) Ingram and Salmon (2010) Jerome et al. (2009) Knapp and Anaya (2010) Krause et al. (2013) Leston et al. (2012) Lindberg et al. (2006) Lorimer and McDaid (2013) Pavlin et al. (2006) Prost et al. (2007) Shoveller et al. (2009) Shoveller et al. (2012) Tomnay et al. (2014) Vaughan et al. (2010)
Being Judged/ Shame	Balfe and Brugha (2009) Lindberg et al. (2006) Oliver de Visser and O'Neill (2013)
Invulnerability/ Perceived Risk	Balfe and Brugha (2009) Deblonde et al. (2010) Mullins et al. (2012) Rose et al (2008)
Lack of Knowledge	Chaudhary et al. (2008) Rose et al. (2008)
Discrimination	de Wit and Adam (2008) Fakoya et al (2008)
Fear	Fakoya et al. (2008) Mills et al. (2006) Pavlin et al. (2006) Rose et al. (2008) Wong et al. (2012)

Preferences for Service Types and Reasons for Not Testing	Studies Citing
Staff Attitude	Hambly and Luzzi (2006) Ingram and Salmon (2007) Knapp and Anaya (2010) Llewellyn et al (2012)
Confidence	Huppert et al. (2011)
Incentivisation	Lee et al. (2014)

Table 4.11 - Preferences for Service Types & Reasons for Not Testing

Of the 43 studies included in the table above, the most frequently cited reason was privacy, confidentiality or anonymity concerns, identified in 24 studies (56%). This was followed by access and convenience of services, cited by 10 of the 43 studies (23%), stigma, identified in nine studies (20%), and embarrassment, cited as a reason in seven studies (16%).

4.3.6 Identification of the List of Potential Attributes

The findings of both literature reviews, along with other key data sources including clinical guidelines and test performance data, were mapped to the key stages in the STI testing and treatment pathway shown in figure 2.1. In considering the inclusion of potential attributes in this list the following selection criteria were used. Attributes were included in the list of potential attributes if they were:

- From the stated preference studies literature review, directly related to the provision of testing and treatment services for STIs in England
- From the broader preference literature review directly related to the provision of testing and treatment services for STIs in England

- Could be inferred from the studies considering values, beliefs, perceptions e.g. stigma associated with testing for STIs. Location of testing and how you access a healthcare professional may impact on stigma associated with attending sexual health service clinic venues.

The attribute long list, along with preliminary definitions, is set out in table 4.12:

Potential Attribute	Preliminary Definition
Sample Collection Method	How your sample is provided e.g. self-sample, you see a healthcare professional and they take the sample for you
Range of STIs Tested for	Which STIs you get tested for e.g. one STI, some STIs, most STIs, all STIs, specific named STIs
Where you do the Test	Where you do your test e.g. self-test at home, self-sample at home and send off for analysis, attend GP practice, community service, sexual health service
Time to Result	How long it takes from providing the sample to getting the result e.g. 15 mins, 1 hour, 2 hours, 24 hours, 7 days, 14 days
Test Accuracy	How accurate the test result is e.g. could be defined as sensitivity, specificity, false positive, false negative etc.
Results Notification	How you get your results e.g. text, email, phone call, internet etc.
Access to a Health Care Professional when you get your result	Whether you have access to a healthcare professional for advice when you get your result.
Treatment Consultation Method	How you have your consultation for treatment e.g. online consultation, phone consultation, video consultation, face-to-face
Where you go to get treatment	If you need to see a healthcare professional in person for treatment where you go e.g. GP, sexual health clinic
Partner Notification Method	How you notify your partner of your diagnosis e.g. in person, by phone, by text, partner notified by a service provider
Type of Health Care Professional	The type of healthcare professional delivering your care e.g. Pharmacist, GP, nurse, sexual health consultant
Knowledge of Health Care Professional	Whether the health care professional has specialist knowledge of STIs

Table 4.12 - Long List of Potential Attributes

The ‘long list’ of potential attributes identified in table 4.12 was taken forward into focus groups with young people as described in the next chapter.

4.4 Summary

Bridges and colleagues identify the need to ensure the use of an evidence base on the “potential range of preferences and values that people may hold” (Bridges et al., 2011:405). They suggest literature review, other evidence on the impact of disease or health technology being assessed, expert opinion, qualitative research and other preliminary studies as the primary sources for attribute identification. The value of the qualitative research process in DCE questionnaire design is summarised by Kløjgaard and colleagues who recognised that their phased approach to qualitative research (incorporating a number of qualitative techniques) in attribute and level selection and questionnaire design had a direct impact on the final questionnaire as understanding and insight would have been missed had the qualitative methods been restricted to one approach (Kløjgaard et al., 2012).

Whilst the importance of qualitative research in DCE questionnaire design is recognised, there is little guidance on how the research undertaken should be applied in the final selection of attributes and levels (Coast and Horrocks, 2007). The ISPOR good practice checklist for conjoint analysis highlighted qualitative research as being a good practice for the selection of attributes, alongside clinical experts and other studies, for both the selection of attributes and potential attribute levels (Bridges et al., 2011).

The publication of information regarding the selection of attributes and levels is problematic with little or no information being published as part of the reporting of a DCE (ibid). A recent review of DCE studies in health economics found a decrease in the use of qualitative methods for attributes selection in studies published during 2001-2008 (69%) to 51% in studies published between 2009 and 2012.

Conversely the use of qualitative methods to inform level selection increased between the two periods from 33% for studies published during 2001-2008 to 40% for studies published between 2009 and 2012 (Clark et al., 2014). This makes it difficult for the reader to consider the implications of the selection of attributes and levels on the interpretation and limitations of the DCE study (Coast and Horrocks, 2007). The question remains as to the degree to which DCEs are sensitive to the process used to develop attributes (Coast et al., 2012).

A key question in the selection of attributes is the balance between what is important in the context of the policy/ service perspective and the perspective of the respondent (Bridges et al., 2011, Lancsar and Louviere, 2008). It is suggested that "the eventual balance of these competing objectives must be guided by the research question and the study perspective" (Bridges et al., 2011:405). It is recognised that it is not always possible to include all relevant attributes and levels within the DCE and Lancsar and Louviere suggest that DCEs need to both capture sufficient relevant attributes to avoid respondents making assumptions regarding missing attributes of importance and that levels are sufficiently different to avoid respondents discounting attributes because of little difference (Lancsar and Louviere, 2008).

Bridges and colleagues suggest that the approach to mitigate this is that “attributes central to the research question or to the decision context must either be included or held constant across all profiles.” (Bridges et al., 2011:405).

Having undertaken two literature reviews to inform the identification of the ‘long list’ of attributes, Chapter 5 outlines the qualitative work undertaken to inform the final selection of attributes and levels to be used in the DCE. This includes the use of focus groups to seek the views of young people on the ‘long list’, and exploring the findings of these with expert groups to incorporate the policy and service perspective to inform a final selection of sensible attributes and levels using an evidence synthesis process.

CHAPTER 5 – SELECTING THE ATTRIBUTES & LEVELS – FINDINGS FROM THE FOCUS GROUPS AND EXPERT GROUPS

5.1 Introduction

This chapter builds on the information presented in Chapter 3 which outlines the rationale for the use of focus groups to inform the development of the DCE, presenting the research undertaken to inform the selection of attributes from the 'long list' identified in Chapter 4, and identification of levels through the use of focus groups, expert groups and evidence synthesis. This chapter is structured into four parts: first, the focus group research undertaken with young people is presented. This includes the detail of the methods used, how the focus groups were conducted and analysed and the findings from this research. Second, the findings from the focus groups are used to inform the development of the expert groups which follow in this chapter. Third, the synthesis of the findings from the focus groups and expert groups to finalise the selection of attributes and levels is presented. Finally, the chapter concludes with a summary of the attributes and levels selected to move forward into the DCE presented in Chapter 6.

5.2 Focus Groups

5.2.1 Focus Group Objectives

As outlined in section 3.6.1 focus groups were selected to contribute to the design of the DCE. The objectives were:

Primary Objective:

- To identify which the themes and factors young people consider important when choosing whether to test for sexually transmitted infections

Secondary Objectives:

- To gain insight into:
    - Reasons for importance of factors
    - Rationale for trading between factors and prioritisation
    - How participants articulate views and opinions on these themes/ factors.

Participant inclusion criteria set for the focus groups were:

- Between the ages of 16 and 24
- Ability to speak English
- Able to consent.

Exclusion criteria were:

- People under the age of 16 and over the age of 25
- People requiring any form of interpreting/ translation services to participate
- People unable to give consent.

In total, four focus groups were undertaken involving 21 young people, the composition of the focus groups is summarised in table 5.1.

Focus Group	No of Participants	Gender	Age Range	Group Type
1	6	4F, 2M	16-17	Existing Group
2	5	3F, 2M	17-18	Existing Group
3	3	3M	18-24	Self-selected
4	7	7F	19-23	Self-selected

Table 5.1 - Focus Group Composition

5.2.2 Focus Group Methods

5.2.2.1 Sampling

Whilst consideration was given to a number of sampling methods, convenience sampling was ultimately chosen for this research due to the challenges with accessing the population and being able to undertake purposive sampling within the time constraints of this phase of the research. The convenience sampling approach is defined as selection based on who is available, they self-select into the sample. Whilst it is recognised that the main limitation of this approach is the impact on the validity (Finch et al., 2014) and generalizability (Babbie, 2012), it is noted that this sampling method is useful in questionnaire design (ibid).

In order to mitigate the limitation, consideration was given to the principal criteria of relevance within the 16-24 age range. Whilst research does suggest there are differences in preferences between demographic groups for different testing and treatment services (Iles & Oakeshott, 2005, Lorimer et al., 2009) there is also evidence that other factors may be more significant such as relationship status (Balfe and Brugha, 2009). The population of interest for this research was the 16-24 age range since this is the population with the highest rates of diagnosis of STIs (PHE, 2016b); the greatest frequency of change of partner (Mercer et al., 2013), and are the highest users of smartphone technology and the internet (Office for National Statistics, 2016b) on which a new remote online pathway is dependent.

5.2.2.2 Focus Group Design

Since language use is important when engaging participants in the focus groups (Krueger and Casey, 2000), research was undertaken to align the language and content to ensure relevance to the 'target' population age range, in order to pitch the content of the focus group at an appropriate level. Websites were reviewed that were designed for the study population age range to inform the style, use of language and content for the planned focus groups.

Those reviewed included BBC Radio 1 and BBC Radio 1 Newsbeat, Respect Yourself (the Warwickshire relationships and sex education website) and Brook (a national charity with a focus on sexual health services for under 25s). Market analysis data was reviewed to identify the most commonly used technology and social media within the age range, along with the most popular television viewing. The design and style of language for the focus groups was then amended to suit, taking into account this review.

When planning the focus groups, time was allowed before each focus group began to enable participants to review the participant information leaflet, formally consent to take part, and for the volunteers to complete the demographic information. The introduction was planned to be brief, thanking participants for their input, outlining the purpose of the focus group and setting out the ground rules for participation. These included:

- Confidentiality – 'what happens in the room stays in the room',
- Respect for the views of others,
- Clarification on the nature of the discussions and that you can leave if you want to,
- Recording of the discussion, if possible to try and avoid speaking over each other (adapted from Finch et al., 2014).

5.2.2.3 The Use of Vignettes and Pilot of Development

It was decided not to use one general, opening topic but rather to set the scene in the context of the upcoming questions and tasks for the focus group. This was because in designing the questions there was a logical flow through the vignettes into the later questions and related exercise and it was believed that the vignettes would offer an easy route into the topic. The scene setting drew on the views of a small number of clinical staff working in sexual health services in London, based on their experience of what prompts young people to attend clinic. References were made to Facebook specifically because this was proportionately the most used social networking site (Ipsos MediaCT, 2015).

In developing the focus group topic guide a key point was identifying the questions to use. Recognising the need for questions to be open-ended, and structured in such a way that participants would be willing to respond to them (Barbour, 2007), careful consideration was given as to how to link them to the vignettes and frame their content with the other connecting dialogue.

To make sure that the vignettes were credible and authentic (O'Dell et al., 2012), prior consultation was undertaken with a small group of clinical staff working on the related eSTI^2 research project. This included two GUM consultants, a research nurse working in the field and a sexual health advisor. An afternoon was spent talking through the plans including the number of vignettes and the degree of detail required. Following this the author drafted three vignettes – one describing a GUM clinical care pathway, one describing an NCSP internet testing pathway and one describing a fully remote online self-testing and clinical care pathway, as envisaged by the overall eSTI^2 consortium.

The fully remote online pathway vignette was informed by a Prezi animation developed by another eSTI^2 researcher used as an introduction to the human computer interaction focus groups. The other two were developed based on what happens to someone if they choose to test at a sexual health clinic, or through one of the NCSP internet testing pathways both of which are comparators within the OCCP exploratory study.

The author drafted three vignettes which were then circulated to the small group of clinical staff for review. The vignettes were then amended taking into account this feedback. It is recognised that it is important for vignettes to be "easily followed and understood, and are internally consistent and not too complex" (Barter and Renold, 2000:314). Thus, care was taken to ensure that the vignettes were written impersonally, as a walk-through of what would happen if a participant chose that route to test for an STI, rather than to shape them around a hypothetical person. It was felt that the focus needed to be on the pathway itself, and therefore to write the vignette as a story about a proposed person might detract from this.

The author decided to read out the vignettes to the focus groups rather than use media such as animation, flip charts, storyboards or videos. The reason for this was two-fold, firstly the level of detail did not lend itself to flip charts or storyboards, and secondly animation and videos introduced reliance on further technology (other than a recording device) and the rooms used for any such focus group might not be able to support this. The vignettes used vary in length as outlined in table 5.2:

Vignette	No of Words
1. Sexual Health Clinic	422
2. NCSP Internet Testing Pathway	306
3. Fully Remote Online Pathway	349

Table 5.2 - Length of Vignettes. For full text see Appendix 11

The first vignette is longer in length since it contains additional information which is referred to in vignettes two and three, thus attempting to avoid direct repetition in the second and third vignettes.

5.2.2.4 Focus Group Structure

Following the introduction, all participants were asked to give their name and to confirm that they understood the ground rules. The topic guide for the first focus group acknowledged that this was a pre-existing group therefore individual introductions would not be necessary. The topic guide was adapted for the final two focus groups as participants selected themselves by responding to an online advert. It was decided to amend the introductory section slightly to ask participants to introduce themselves to the group as part of the confirmation process. A broader introductory task was not included as the facilitator aimed to encourage informal dialogue prior to the commencement of the focus group between participants.

The overall structure of the focus group was to ask each group of participants the same questions after each of the three vignettes, opening by asking if there was anything to ask about what they had been told. It was important to check comprehension at this stage since it was anticipated that the majority of participants would not have previously used sexual health services. The next question asked about each vignette was 'can you think of the things in the example that might make a difference to whether you decided to use this service? What do you particularly like or don't like?', thus aiming to prompt the participants to reflect on the vignette they have just listened to, in order to start to identify factors.

The second part of the focus group centred on exploring these factors in more detail using a further three questions, again to draw out the most important ones. It started with a paragraph which asked participants to reflect and compare the factors, to think about whether there was one particular thing about an option that makes it more attractive than another, or to think about if there were things that would be important which haven't been covered by the examples talked through. Two explicit questions were asked about what the most important factors in making a choice about which service to use were and why, and whether they could think of any other factors about the service that had not been talked about so far that would be important in deciding whether to access that service.

The final question in this section was to run through factors other people had identified as being important in making a decision that had not come out of the discussions, and participants were asked to shout out whether they thought they were important or not and why. These factors were drawn from the literature reviews.

The questions were written to be open ended and in language appropriate to the participants as is identified good practice for focus groups (Millward, 2012, Krueger and Casey, 2000). For this part of the focus group, cards with factors on were prepared in advance and held by the facilitator. These cards were based on the factors identified in the vignettes, and other known factors from the literature review which were not included in the vignettes. These primarily related to product characteristics e.g. sampling method and test accuracy.

The final task within the focus group was a prioritisation task. This was selected because task based activities can stimulate discussion in focus groups in a way that asking open ended questions cannot (Krueger and Casey, 2000). The exercise was not intended to be a formal ranking exercise. The task was modelled in the style of an X-Factor results show (reality TV show) with participants asked to work as a group with the cards used during the second stage of the focus group eliminating one factor from the bottom two each time to get ultimately get to a 'winner'. The X-Factor was chosen as it was the highest rated UK talent series within the 16-34 age range (Freemantle Media UK, 2014) and was the most "tweeted about" TV show during 2013-14 (Haggerty, 2014).

The topic guide ended with thanking participants for their time, setting it in the context of what will happen next and how the outputs will be used, and offering them the opportunity to add anything else before the group concluded. The guide was written as a full script to act as an aide memoir for the facilitator however it was planned only to read the ground rules and vignettes verbatim. The topic guide was reviewed by the PhD supervisors, and tested informally on research colleagues who have experience of working with young people to check comprehension and language. Final amendments were made prior to the first focus group. A copy of the full topic guide is included in Appendix 11.

5.2.2.5 Data Management and Analysis

"Focus groups can provide a rich, complex and extensive data set for social researchers. However, many of the potential advantages of these data are lost in the absence of appropriate methods of analysis" (Frankland and Bloor, 1999:144-5).

Thematic analysis was selected as the core approach to analyse the focus group data recognising that this is one of the three 'main methods' for analysing focus group data (Silverman, 2014) and is the method most closely aligned to that used to design the focus group. In managing and analysing the data the process outlined in the figure 5.1 was adopted to ensure the effective management and analysis of the focus group data. This was selected as it summarises a recognised process for the management of qualitative data (Spencer et al., 2014b).

Both Saldana and Morgan recognise the need to ensure that coding and analysis are appropriate for and aligned to the research question and the information requirements of the project (Morgan, 1997, Saldana, 2013). In taking forward the preliminary coding undertaken on the hard copy transcripts, consideration was given to the coding approach that would be applied and its impact on the analysis. The specific purpose of undertaking the focus groups was to identify the attributes that are important to young people in accessing sexual health services. The outputs were used to inform the development of a DCE and it was recognised that the focus groups may yield other information useful to its design including the development of the introductory information, and input into attribute levels.

Considering Saldana's first cycle coding methods, three specific coding types were identified as being relevant to the coding of the focus group data – descriptive coding, emotion coding and values coding (Saldana, 2013). These are defined in table 5.3:

Coding Type	Definition
Descriptive Coding	Summarises the topic of the discussion (rather than its content)
Emotion Coding	Summarises the emotions expressed by participants in relation to the topic
Values Coding	Summarises the values, attitudes and beliefs expressed by the participants in the discussions

Table 5.3 - Definition of Coding Types (Saldana, 2013)

Descriptive coding was used to focus on specific properties that were discussed in respect of the tests and services. Many of these codes were identified a priori as they centred on tangible and known factors that were identified as part of the literature review and focus group development.

Emotion coding and values coding were used to capture the participants' beliefs, feelings and perceptions on their views of the specific attributes and properties. Saldana draws attention to the importance of coding both values and emotions in research as participants' actions and views cannot be separated from one another. "Since emotions are a universal human experience, our acknowledgement of them in our research provides deep insight into the participants' perspectives, worldviews and life conditions" (Saldana, 2013:106). These codes were identified on the first read through of the transcripts.

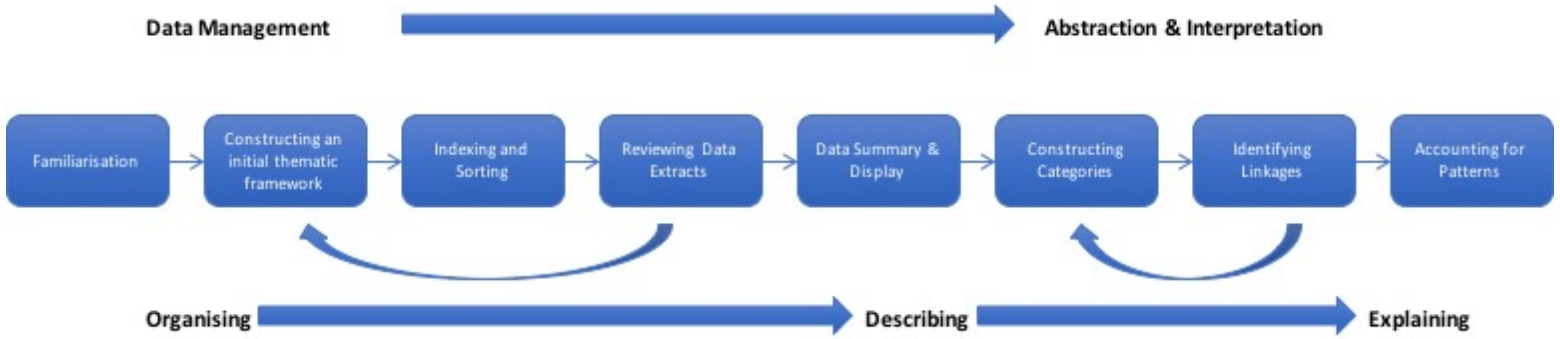

Figure 5.1 - Process for Managing & Analysing the Data. Source: Spencer et al., 2014b:280

5.2.3 Conducting the Focus Groups

In order to identify ways to access the population, a group of experienced researchers in the field, based at the Studies in Adolescent Sexual Health (SASH) Group at Coventry University, were approached for additional advice into what worked well for them when gaining access to young people to participate in research. Their suggestions included targeting the education sector (sixth form, further education colleges and universities) and the voluntary sector (youth projects and the youth organisations).

Recognising the reliance on participants choosing to opt in, approaches were made in a staged way to enable the management of recruitment to ensure a spread of responses across the age range. The following demographic information was captured from participants:

- Age
- Gender
- Ethnic group
- Sexual preference
- Whether previously tested for an STI
- Highest qualification
- Employment status.

Initial contact was made with organisations working with the younger end of the age range including schools with sixth forms and youth organisations. A standard cover letter, along with a copy of the participant information leaflet was sent to contacts identified from the organisations' websites.

Once the first two focus groups were undertaken, the participant demographic information was reviewed which confirmed that the majority of participants were aged 16-17, therefore subsequent organisations targeted enabled the recruitment of participants over the age of 18, including further education colleges and universities. The same standard cover letter and participant information leaflet was sent. A point of interest from reflection on the first two focus groups was the interaction between the participants. The two focus groups were formed from a pre-existing group (participants known to one another in advance) and considering the methodological literature on this topic the author decided, if possible, to seek participants who were not part of a pre-existing group to explore whether this was significant in the findings.

The recruitment of participants through organisations addressed some of the key issues with group composition, particularly by recruiting through organisations where young people already share common ground, either through attendance at the same educational establishment or participation in the same youth group or project.

Recruitment into the focus groups provided to be more challenging than originally anticipated, with difficulties in securing access to relevant people following the initial contact letter by telephone or by email. Non-response was a greater issue than negative responses. The initial group to engage was a youth organisation, a pre-existing group of young people who meet fortnightly. Members of the youth organisation were identified as predominantly 16-17 years old and female during the initial organisation of the group. The final two focus groups were recruited by online advertising at a university. Participants opted into both focus groups, the youth organisation via a decision to attend on the scheduled night, and the university via response to an advertisement.

Finch and colleagues outline five key practicalities to consider when organising a focus group – timing, venue, 'hosting' the group, observers and co-moderators and recording (Finch et al., 2014). It was recognised that the timing and venue for the focus groups would be determined by the organisations agreeing to participate. The author was able to be flexible to meet the requirements of the participants both in terms of timing of focus groups and venues. In terms of 'hosting' the group, chocolates were provided as people arrived at the focus group whilst they were reading and completing the consent and demographic information. 'Love 2 Shop' vouchers (£10) were offered to focus group participants, as a small token of their time. A record of the voucher distribution was kept for research audit and to meet current institutional financial regulations.

Given the amount of information being imparted, accompanying written materials were developed for participants. These were:

- A printed summary slide of each of the three vignettes,
- A comparative table, drawing out the key features of the pathway, and what happens in each of the three vignettes.

The written materials were on the table ready for each of the participants at the start of the focus group.

The author was the facilitator for all four focus groups. The room was organised so that seating was in a circle and the facilitator sat with the group as part of the circle. The focus groups were audio recorded using MP3 equipment. All equipment was tested before each focus group then placed centrally within the group to maximise the quality of recording of participants. The four focus groups varied in length slightly with the shortest being 60 minutes and 18 seconds, and the longest being 65 minutes and 45 seconds.

This provided a total of just over four hours' data and amounted to approximately 32,500 words and 83 pages of data for qualitative analysis.

In total there were 21 participants across the four focus groups, a summary of the number of participants and their gender is provided in table 5.1. The socio-demographic characteristics of the focus group participants are outlined in table 5.4.

	Number	%
Age		
16-17	11	52
18-24	10	48
Gender		
Female	14	67
Male	7	33
Ethnicity		
White	10	48
Asian/ Asian British	10	48
Black/ African/ Caribbean/ British	1	5
Sexuality		
Heterosexual	17	81
Homosexual	2	10
Bi-Sexual	2	10
Tested for STI Previously		
Tested	4	19
Not Tested	17	81
Highest Educational Attainment		
GCSE	6	29
A-Level	11	52
Diploma	1	5
Degree	2	10
Post-Graduate	1	5
Employment Status		
Student	19	90
Unemployed	1	5
Employed	1	5

Table 5.4 – Socio-Demographic Characteristics of Focus Group Participants (note percentages may not sum due to rounding)

5.2.4 Data Management

Adopting the process outlined above (figure 5.1), the transcription process provided an important key part of data familiarisation stage. All focus group data was transcribed by the author, thus providing a valuable opportunity to listen to the recordings first hand, and therefore becoming more familiar with the contents in preparation for the main analysis. Notes on non-verbal communication were incorporated at this stage, thus helping to develop preliminary categories for qualitative analysis coding.

The transcription process was undertaken using the audio playback function in NVivo for Mac 2010, dictated into Microsoft Word using Dragon Dictate. All focus group meetings were transcribed verbatim excluding the introduction and conclusion given by the facilitator, and the use of vignettes read out to all four focus groups. Notes were made in the transcripts for any other aspects of the recording e.g. laughter, non-verbal communication noted by the researcher during the focus group and content which was inaudible due to 'group noise'.

These transcripts were then hand checked for errors by listening to all the recordings and annotating any corrections needed in hard copy, prior to updating the electronic copy. This review process enabled the initial identification of topics to code. These hard copies were annotated with potential codes initially falling into two categories:

- Observations/ statements made by focus group members;
- Questions asked of the facilitator by focus group members.

5.2.5 Data Analysis

The thematic analysis coding was split to examine questions asked and observational statements separately to distinguish between points of clarification and views on potential factors. An iterative approach was adopted, reviewing each focus group transcript in order. On completion of each focus group transcript review, the outputs were entered into Mindjet MindManager. This enabled the collation of initial thoughts on codes from the first review of the transcripts into an electronic format which was then visually sorted into groups and subgroups to inform the development of the initial coding framework. Detail of the initial codes is shown in figure 5.2.

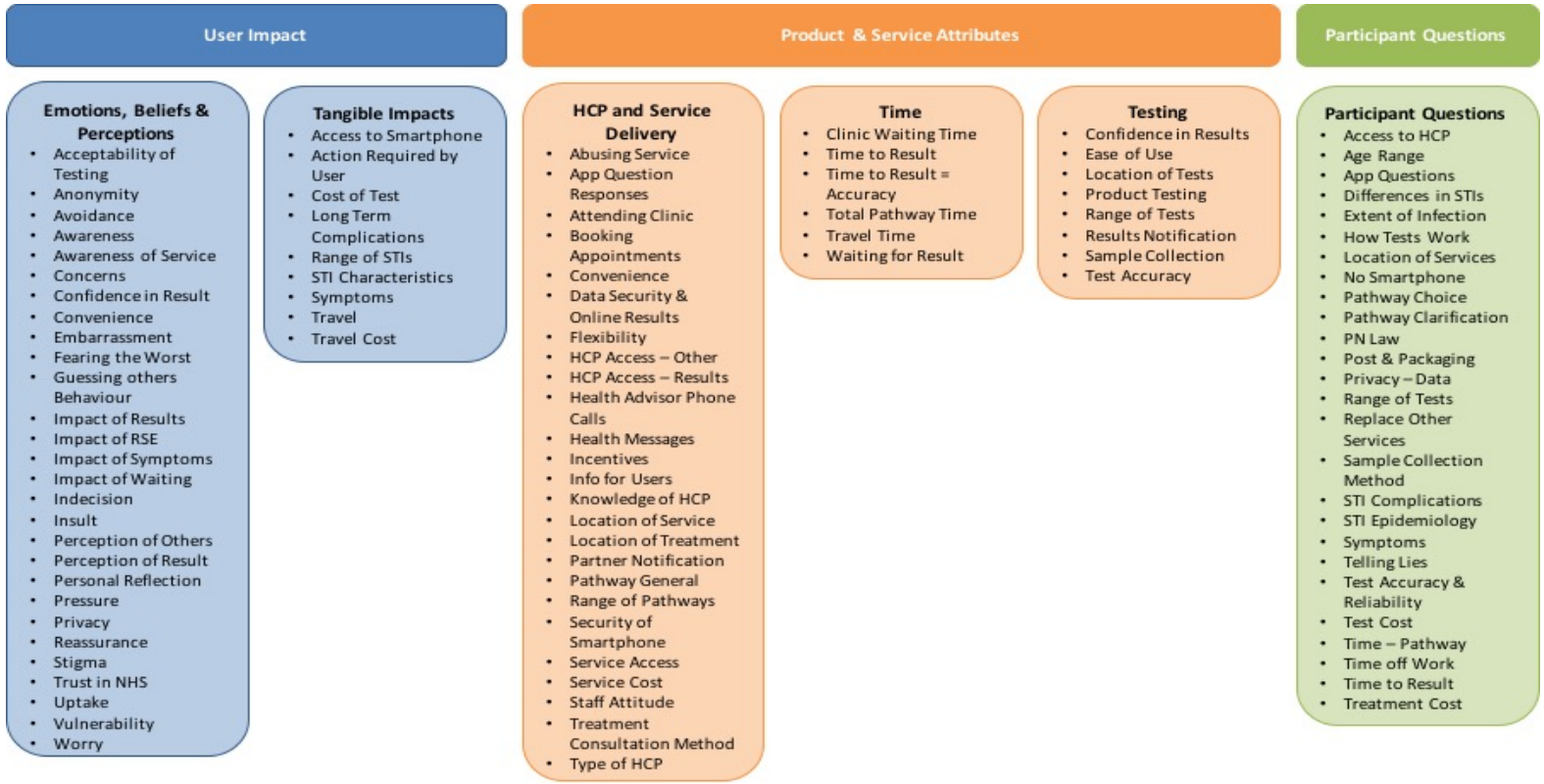

Figure 5.2 - Draft Coding Framework[2]

[2] RSE – Relationships & Sex Education, STI – Sexually Transmitted Infection, HCP – Health Care Professional, PN – Partner Notification

This structure was then input into NVivo 10 for Mac (QSR International) and a coding directory was drafted to assist with consistency in the subsequent application of thematic codes.

The process of indexing (or coding) the data took place in NVivo 10. The opportunity was taken to code the data 'from scratch' against the draft coding framework rather than referring back to notes on initial codes made on the hard copy which were used to develop the draft coding framework. This provided the opportunity to identify areas coded differently and then to consider the reasons for this. One important point to note is that the ranking exercise undertaken at the end of the focus group to stimulate discussion was coded in a slightly different way to the main focus groups. Specifically, coding focused on statements made by the participants which added depth to the understanding of why they thought a factor was important rather than just an indication of their view on its relative importance.

Two queries were then run in NVivo, the first to sort the data to enable the researcher to review the data by code, and the second a matrix query to examine the utilisation of codes within and across focus groups. This was undertaken to aid consideration on whether rationalisation or expansion of the coding framework was required.

As a result of reviewing the results of the two queries a number of modifications were made to the coding framework:

- Rationalisation of codes where grouping could be made without loss of fidelity;
- Realignment of sub-codes within coding framework;
- Adjustments to names of sub-codes for participant questions and observations made by participants to enable more effective thematic analysis across codes.

Revisions were made to the coding framework in MindManager to review prior to completing the changes in NVivo 10. Queries were re-run to enable review of the data extracts within the revised themes. The revised coding framework is shown in figure 5.3.

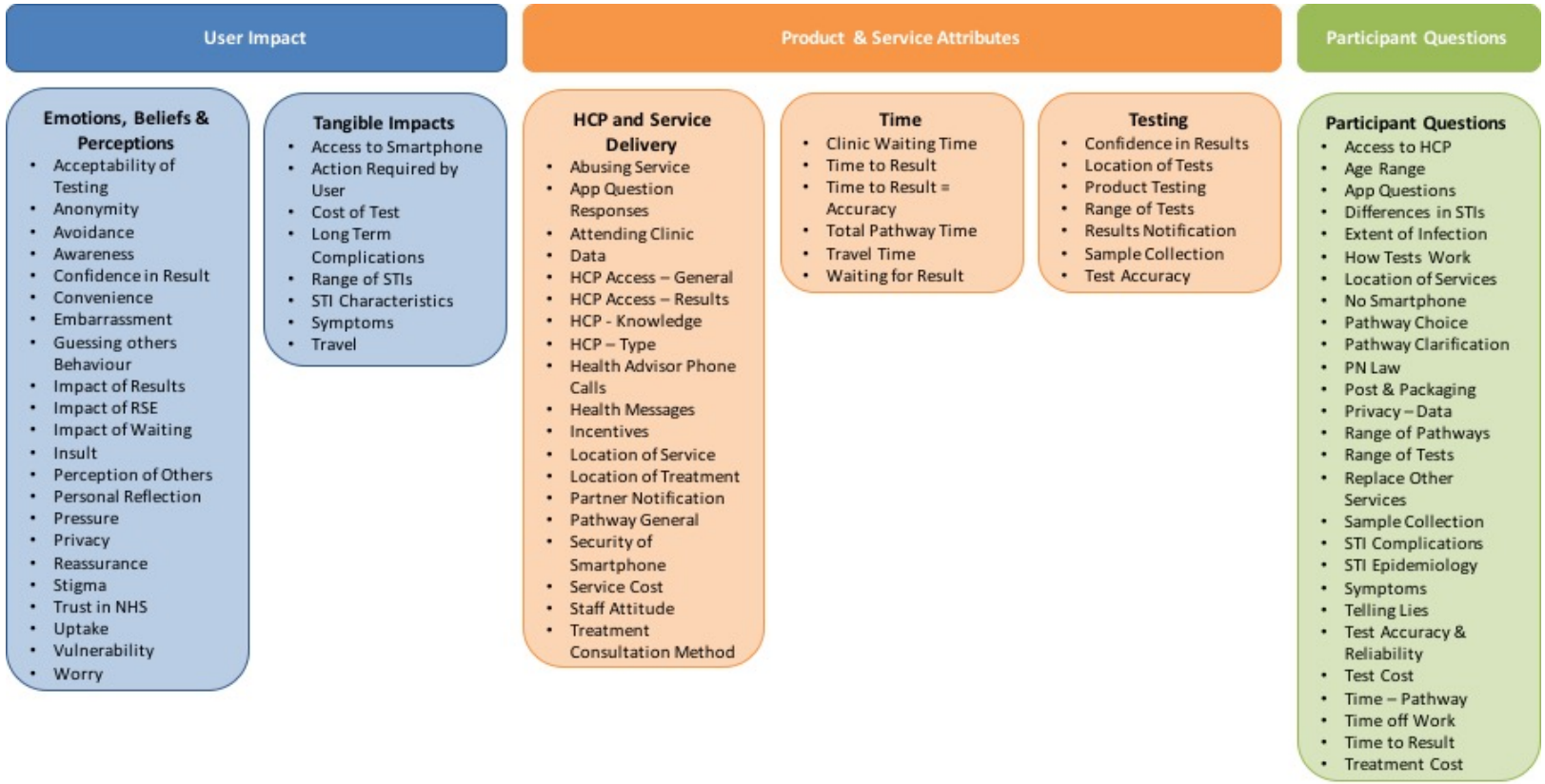

Figure 5.3 - Revised Coding Framework[3]

[3] - RSE – Relationships & Sex Education, STI – Sexually Transmitted Infection, HCP – Health Care Professional, PN – Partner Notification

All data were then analysed at focus group level, that is, the group is the unit of analysis rather than the individual participant (Spencer et al., 2014a) and data summaries by code were organised by focus group. A summary of the high level themes and coding categories is shown in table 5.5:

	Brief Description of Codes
Category – Product & Service Attributes	
Theme - HCP and Service Delivery	Tangible service characteristics relating to health care professionals and service delivery (excluding testing)
Theme - Time	All aspects associated with time involved in testing and treatment for STIs
Theme - Testing	Specific to the test element of the pathway, test properties, sample collection, results notification
Category – User Impact	
Theme - Emotions, Beliefs and Perceptions	Values, attitudes, beliefs and emotions in respect of sexual health services. Personal reflections and reflections on others' behaviours and views on services
Theme - Tangible Impact	Physical (rather than emotional) factors having an impact on the user
Category – Participant Questions	
Theme - Participant Questions	Questions asked of the focus group facilitator, seeking to provide clarity on an aspect of STIs or service delivery

Table 5.5 - High Level Coding Categories and Themes

Data summaries in conjunction with matrix coding queries were used to structure the analysis. Starting initially with the factors relating to the service and product characteristics the most frequently coded sub-themes, common to the majority or all focus groups were reviewed to identify:

- what participants said about a particular factor,
- variation within and between groups in their views of a particular sub-theme,
- how they linked (or did not link) the sub-theme to other sub-themes or themes (e.g. values or emotions).

This enabled the findings to be grouped into three overarching categories for further exploration, outlined in detail in section 5.2.6. Participant questions was established as a separate theme recognising their potential contribution to the development of the background and introductory information for the DCE, as well as identifying potential attributes and levels. The discussion seeks to build on this, offering explanation for the linkages found and exploring the impact of the use of the focus group method including the role of the facilitator, the use of vignettes and the impact of group dynamics on the findings. The discussion of the strengths and limitations of this research are presented in section 5.2.7.

5.2.6 Findings

The findings were grouped into the three categories identified from coding the focus groups as outlined in table 5.5. The categories build on each other but are presented in this section in order of frequency. Firstly, exploring the individual product/ service characteristics of sexual health services and whether the focus group participants considered them important and how they traded between them. The second category built on this and considered the impact of values, beliefs, perceptions and emotions in the participants' consideration of importance – whether there was an indicator as to what drives their view on importance. The final category looked at the understanding of STIs and sexual health services and how this may shape or influence views. The findings in the following sections are presented by category using the colours assigned in figure 5.3 to link the quotes to categories; sub-themes (codes) are highlighted in bold and italics, with supporting quotes from focus group participants provided for each point made. The sub-themes are presented in order of frequency of discussion and follow the natural linkages made by focus group participants.

5.2.6.1 *Category - Product and Service Attributes*

Time to result was the most consistently discussed sub-theme across all four focus groups. The vignettes presented three pathway options with time to result at 15 minutes, 7 days and 14 days. The view across all four groups was generally consistent in the consideration that the quicker results were available the better:

> *"It's good though that they do find out in seven days"* FG1, Female, age 16 or 17
>
> *"I think what I like about this because I've been going on about it is timing, I mean 15 minutes compared to 14 days and 7 days like I'll be more likely to use that service because you get it in …"* FG2, Male, 17

However, this was by no means universal with one participant equating time to result with accuracy, indicating a preference for a longer waiting time:

> *"I mean like, compared to like I feel it's it might be more accurate because it takes like 14 days to actually like go through a proper test and stuff"* FG4, Female, 19

The main reason indicated for preferring a shorter waiting time is due to worry and anxiety about what the result will be:

> *"… and then you're waiting those seven days, I think it's just the worrying bit that would get to me, like worrying if you've got it what you do, how would you react and cope FG2*, Male, 17
>
> *"… it might become clear in your workplace or at home and social life that clearly you're anxious because it's hard isn't it to think that you are going to forget for two weeks the fact that you sent off a test for an STI"* FG1, Male, 16

Consideration of trade-offs for ***time to result*** were highlighted by participants, particularly ***test accuracy, range of tests*** and ***knowledge of the HCP***:

> *"… 15 minutes is nothing it's in comparison to two weeks or a week if that so this one is brilliant for time I suppose, but maybe not as good for really… don't know how you say it, accuracy?"* FG1, Male, 17

> *"… because waiting time is a huge deal because I'd just be worrying for those 14 days or those 15 minutes but I'd rather it be 15 minutes, erm then I'd be very conscious of if I'm not getting tested for certain things and then I'd be very conscious of how accurate it is, so I think overall I'd probably go for the sexual health clinic…"* FG2, Male, 17

> *"… but as he said before if you've got to wait longer but the person like that is going to be telling you has more knowledge surely…"* FG1, Female, Age 16 or 17

> *"Although it's more convenient considering the fact you get to do everything over the Internet and if that takes seven days and this takes 14 days from your home it's always more convenient and it saves you travel cost and everything, but er yes, I think erm if you would cover more tests it would definitely be better"* FG3, Male, 24

Time to result dominated discussion compared to other aspects of time involved within the pathway such as ***clinic waiting time*** with one participant acknowledging:

> *"so if the waiting time were shorter I would definitely think of going more often…"* FG4, Female, 21

and ***total pathway time****:*

> *"It takes ages, in theory it could take like 17 days…because you have to order it as well"* FG1, Male, 17

These findings are in line with findings from other published studies which recognise that reduced waiting time enhances the acceptability of a service e.g. self-management within a GUM clinic (Baraitser et al., 2011, Fernando and Thompson, 2013, Martin et al., 2013), within mainstream sexual health services - speed of service and time to result being the second and third most important aspects of care (Hitchings et al., 2009) and rapid testing within primary care (Schwandt et al., 2012).

Reduced time to result has been found to be both an important factor in acceptability of HIV testing in community locations (Guenter et al., 2008) and HIV testing in general (Peralta et al., 2007, Tomnay et al., 2014, Turner et al., 2013), although other research has found that in the case of rapid testing for HIV time is preferable to enable an individual to come to terms with the impact of the result outcome (Cohall et al., 2010).

Test accuracy also featured consistently in the discussion as an important factor for young people. On reflection, this sub-theme stands out because it was introduced into the discussion by young people in three out of four focus groups, although it did not feature in the vignettes. Concern that the result would be wrong and confusion that the tests would not be 100% accurate featured in all four discussions among participants:

"Well I would say like reliability because you don't want to think you have an STI when you actually don't" FG1, Female, 17

"… it doesn't really matter, it's all about the same accuracy" FG1, Male, 17

"Are the ones at clinics more accurate than home tests?" FG1, Male, 16

"I'd order online if that would be more likely to be accurate" FG2, Male, 17

"Why don't they just do like three or four tests when someone goes in to ensure the accuracy is going on?" FG2, Male, 17

"I think it's not really something that you can have that isn't accurate because it's like obviously a lot of the time you don't recognise the symptoms, you don't know that there any symptoms and it's not like being pregnant where if you're throwing up every morning it's probably quite likely…" FG2, Female, 17

"that is, that is quite important but again it depends on if you're saying that the clinic is 99% and this is 95% then I think I'd still be inclined but if there is a larger difference then…" FG3, Male, 18

"Yeah the accuracy, it's erm, I don't mind 1 or 2% of difference but because erm this is convenient you get the results within 15 minutes, but the rest is like a week or two..." FG4, Female, age unknown

Consideration was given to what accuracy means in terms of results, this was expressed by participants in terms of false negatives and false positives. Concerns erred slightly more towards false negatives, i.e. being told that you do not have the disease when you actually do:

"Well the reverse of that as well as if it comes back negative and you actually have one…" FG1, Male, 17

"…because it's like obviously a lot of the time you don't recognise the symptoms you don't know that there are any symptoms…" FG2, Female, 17

"… and I would be worried especially if it was a negative result because I wouldn't be sure, what if I still had it you know the disease?" FG4, Female, age unknown

"Well I would say that like reliability because you don't want to think you have an STI when you actually don't" FG1, Female, 17

"… they would interpret that as like, well I still might not have Chlamydia or gonorrhoea, and then they just go to the doctors and this would be pointless…" FG2, Male, 17

One participant highlighted concern about the impact of false positives in respect of treatment, but no concerns were expressed by participants in respect of the 'life impact' a false positive result could have for either themselves or their partners:

"So couldn't an issue be that if you, if you were tested positive but like it was a false positive that getting like a prescription on your smartphone that would cause issues that like you're like going for treatment that you don't need?" FG1, Female, Age 16 or 17

Participants highlighted their ways of compensating for accuracy concerns through multiple testing and testing through more than one route. In their comments, there was a clear underlying perception that the self-test would be less accurate than a test undertaken at a clinic:

"So you could always take two tests home, that's what I'm going with, you might as well…" FG1, Male, 17

"Can you not do it several times, test yourself several times if you get the same result then…" FG3, Male, 20

"… I'm not sure how much I would trust it because it's just technological based, I would rather go and see a professional just to make sure those are the right results…" FG4, Female, Age unknown

"…it would be good to recommend for them to either do another test or go somewhere else, to get another one…" FG2, Female, 17

Again, the desire for an accurate test result among individuals considering testing for STIs had been identified in other peer reviewed research, although the number of studies exploring this is significantly fewer than those considering time to result. Llewellyn and colleagues identified concerns regarding accuracy of home sampling kits impacted on their acceptability to MSM, as did Rompalo and colleagues in their study exploring the acceptability of home testing POCT within the general population (Llewellyn et al., 2009, Rompalo et al., 2013).

The ***range of tests*** was also an attribute central to discussions in all four focus groups. Participants' lack of prior knowledge about STIs was a common sub-theme in discussing the range of tests, particularly whether they would be experiencing symptoms:

"Yeah definitely if you don't know what you had and you had no symptoms it would probably be better to have more tests than…" FG1, Female, 17

whether the infections were treatable:

"I think what you're getting tested for cos even though those two do chlamydia and gonorrhoea the fact that HIV is the worst one in that you've got it for the rest of your life and that isn't getting tested in either of these I think is quite bad…" FG2, Female, 17

and the assumption that a negative result for one STI would be interpreted that they are negative for all STIs:

"Yet people might interpret that as they're the only two you could get because there are some people who might actually think wow these are the only two which I could get because I couldn't, they might not even bother to test for anything else just because that's negative…" FG2, Female, 17

"I think the choice here is not much, you just get tested for just two of the STIs so that again is something that has to be taken into consideration you may have something else" FG3, Male, 24

Peace of mind (reassurance) was identified as being the overarching reason for participants' preference for more tests:

"…I'd be very conscious of if I'm not getting tested for certain things" FG2, Male, 17

"… but then you have two out of so many that haven't been tested, I think I'd go for the first one just to have a safe mind, to make sure…" FG3, Male, 20

"… but depending on the situation I think I'd still feel uncomfortable not knowing if I've been checked for other things too…" FG3, Male, 20

"…well I think if you get tested for more erm kinds of STIs you're more like assured of your health conditions" FG4, Female, age unknown

Range of tests was identified as an attribute in both Miners and colleagues and Llewellyn and colleagues DCE exploring user preferences for testing for STIs. They identified participants were 2.19 and 4.06 times more likely to choose services which tested for all STIs rather than some STIs respectively (Miners et al., 2012, Llewellyn et al., 2013).

In itself this finding is misleading as current clinical guidelines are such that the range of STIs tested for in a GUM clinic are a core four (Chlamydia, Gonorrhoea, HIV and Syphilis), and any further tests undertaken are selected based on the risk exposure of the patient (BASHH, 2006). The qualitative research undertaken by Llewellyn and colleagues to enable the development of the DCE highlights the range of tests offered as being a factor in choosing to attend a GUM clinic rather than a GP (Llewellyn et al., 2012). This was also borne out in a study by Hambly and Luzzi exploring patient preferences for GUM or GP based sexual health services. They found that 59% of patients preferred to attend GUM compared with 30% preferring GP services and the range of tests was identified as an important factor in this decision (Hambly and Luzzi, 2006).

Peace of mind (reassurance) was also reflected in considering ***access to a healthcare professional***:

"I think a disadvantage of this one would be that like medical reassurance because you're not really in contact with a medical professional so…" FG1, Female, age 16 or 17

"I think just going to a clinic seeing a professional about it I think it's a bit more reassuring in a sense if you do have it or you don't have it then there's someone right there…" FG1, Female, age 16 or 17

"I feel like someone talking to me is more, I feel more reassured…" FG4, Female, age unknown

"I think if for me it's more comfortable to get professional walk you through the processes and and to give you kind of psychological support some time because you, you might be feeling some uneasiness or depression when you get STI tests…" FG4, Female, age unknown

However, this was balanced by participants highlighting a desire for ***privacy*** and ***embarrassment/*** discomfort at discussing their sex lives with an HCP:

"Some people don't like… feel awkward, they might not want to speak to anyone about, like a doctor or a nurse, they might rather do it themselves…" FG2, Female, 17

"If you've got to say to someone, if you're uncomfortable about talking about sex, you are going to say to someone when was the last time you had sex, and if you use protection, and whether they're your partner… That's a bit like, some people might feel uncomfortable doing that" FG2, Female, 17

"…and if you're just answering on the app it might be a bit more, you know comfortable… less intimidating" FG2, Female, 17

"I think maybe even with the doctor that could be a bit awkward if you have to tell them about your sexual past, some people might not really like that…" FG3, Male, 20

Participants provided insight into ***access to a healthcare professional*** generally within the pathway, ***access to a health care professional when they got their results, sample collection method*** - whether the test sample was a self-sample or taken by an HCP, and ***treatment consultation method*** – how they engaged with an HCP to get treatment.

In respect of ***sample collection method*** the input of an HCP into taking the sample was not considered important with one reference to HCP input being beneficial:

"… so there's less privacy but maybe they know what they're doing better than you would if you were doing the test yourself so…" FG4, Female, 21

This is borne out by the majority of published studies that have found self-sampling and/ or self-testing to be acceptable in asymptomatic patients as summarised in table 4.9.

Whereas being able to ***access a healthcare professional when they got their results*** was more important than at the point of taking the test:

"especially if you're positive" FG1, Male, 16

"…I think that if it says that you're positive then you're like what do I do now, I think sometimes it would be better if there was someone that rang you and talked through your options" FG2, Female, 17

"talking to a person definitely feels better as I mentioned erm I think yes I do support the fact that you should be able to talk to someone right after your results come back" FG3, Male, 24

Again, this is supported by the published research findings which express concern at the lack of access to a healthcare professional including Bilardi and colleagues who found that HIV self-testing would be valuable but could not replace existing testing routes due to the lack of professional expertise and support (Bilardi et al., 2013), and Greacen and colleagues who found that those not interested in HIV self-testing cited not wanting to be alone when getting results as a limiting factor (Greacen et al., 2013). Prost et al (2007) found that post-test support was a limiting factor in outreach for HIV rapid testing. In considering more general STI testing support for individual's receiving a positive result has been identified as a concern for the acceptability of internet based testing and other remote care pathways (Hottes et al., 2012, Llewellyn et al., 2009).

Despite the desire to have ***access to a healthcare professional when they got their results*** how they were notified of their results ***(results notification)*** was considered a sub-theme of low importance when it comes to making a decision on whether to use a service with a number of comments along similar lines:

"As long as I know I don't really mind" FG1, Male, 17

"….Ok I think the option of getting a text, getting a call, getting on the app they're all very similar to me to be honest, that wouldn't bother me too much" FG3, Male, 20

However participants in one focus group did highlight a difference of opinions in results notification for positive rather than negative results:

"Or does it depend how serious it is though like… because if it's serious then I'd rather have a phone call than a text" FG1, Female, 17

"It would be quite, I don't know serious, as to get a text to say you've got HIV or you're HIV positive" FG1, Male, 16

"Well it's still a personal conversation, it's a lot better than a text to say you've got syphilis, best of luck" FG1, Male, 16

Considerable research has been undertaken on patient preferences for results notification for STIs, this has found that people want to be notified of all results (including negatives) rather than just positives (Brown et al., 2008, Miners et al., 2012, Patel et al., 2006), and generally prefer a remote notification method such as text for negative results and in person method such as phone for positive results (Martin et al., 2013, Saadatmand et al., 2012).

A number of studies have looked at preference for method and results (based on the number of studies) have identified a preference for phone, (Holloway et al 2011), with Knussen and Flowers noting a preference for calling in rather than being called (Knussen and Flowers, 2007), text (Miners et al., 2012), accessing a website to get results (Ling et al., 2010) or email (Brugha et al., 2011).

Within ***treatment consultation method*** (online, phone, face-to-face) how ***access to a healthcare professional*** was provided was not a major consideration within any of the focus groups however participants expressed some clear individual preferences:

"Personally I wouldn't Skype over syphilis" FG1, Male, 17

"I couldn't take anyone seriously if I was on my bed [with someone] telling me I've got HIV" FG1, Male, 17

"I definitely have a preference and that would be at the clinic. I don't particularly like talking to people on the phone, personally I don't know why, I don't know what it is but I just don't like talking to people on the phone and over the Internet it's the same kind of thing you don't feel like you're talking to a real person, anything that we're agreeing here it is nice to talk to a real person" FG3, Male, 18

This is in contrast to a small number of specific studies exploring telemedicine options within sexual health services for young people. Garrett and colleagues found that young people preferred in person consultation (85%), compared with 63% for telephone consultation and 29% video consultation (Garrett et al., 2011). This view was different in a subsequent study considering young people in rural locations who identified that telephone consultation was preferable to face-to-face consultation (Garrett et al., 2012).

Within the context of ***access to a healthcare professional*** two other related attributes were discussed ***knowledge of the healthcare professional*** (specialist knowledge of STIs) and ***type of healthcare professional*** (e.g. doctor, nurse or pharmacist). The degree of importance placed upon knowledge varied between focus groups and participants within focus groups:

"As important as getting the test results is, it's quite useless if you get a positive result and the person you go to see has rather vague or basic knowledge…" FG1, Male, 16

"I don't think this matters because you're getting the test done so the knowledge of the healthcare professional you go and see doesn't matter you, until you find out what your results are" FG1, Female, age 16 or 17

"But surely the person in healthcare, healthcare is not really easy to get into if you can be in it you are going to be trained. If you go ok I've come back positive for chlamydia they're not going to go I dunno what that is" FG1, Male, 17

This assumption about the being a healthcare professional is also reflected in the impact of views on trust in the NHS. In effect, it can be seen to mitigate the importance of an attribute within focus group discussions:

"I think I was going to say the answer is if it was really that threatening then they would deliver it faster" FG1, Male, 17

"it would be by the NHS I suppose so…" FG3, Male, 20

"I think erm, I kind of trust the NHS to look after me in whatever way I need to be looked after…" FG3, Male, 18

Although the views were mixed on ***type of healthcare professional,*** when it came to the group ranking task, type of healthcare professional was ranked below ***knowledge of the healthcare professional*** in three out of the four focus groups:

"well all that said I'd rather see a sexual health specialist than a GP. If I had my suspicions and…" FG1, Male, 17

"…specialist would always be better but then again erm it's not a big deal I don't think" FG3, Male, 24

"I would prefer a doctor compared to a nurse I think they are more experienced and can like, can understand your situation and the symptoms of your infection maybe" FG4, Female, age unknown

Drawing together the published literature on type and knowledge of healthcare professional, Baker and colleagues found that patients were comfortable consulting with GPs on STIs, and this increased if the GP had a specialist qualification in sexual health and reduced if they knew the GP socially (Baker et al., 2013) whilst Gray and colleagues noted a higher percentage of people identifying their GP as their preference for accessing sexual health services (Gray et al 2009).

Hambly and Luzzi identified specialist knowledge as being one of the most important factors identified by patients in considering their preferences for GUM services compared with GP services (Hambly and Luzzi 2006), a view supported by the findings of Miners and colleagues and Llewellyn and colleagues who found that 'perceived expertise' was a key preference expressed by people when choosing between GUM and GP services (Miners et al 2012 and Llewellyn et al 2013), and Tomnay and colleagues found that generalist rather than specialist sexual health services was a barrier to online STI testing (Tomnay et al 2014).

However, Hitchings and colleagues found that 'technical expertise' was one of the least valued aspects of sexual health services (Hitchings et al 2009).

Through the focus group discussions an overlap between the ***location of treatment*** (outlined in the vignettes as completion of online consultation pathway, GP or pharmacist consultation or attend a sexual health clinic) and ***treatment consultation method*** (online, by phone, in person) as factors was identified. Views were mixed on the importance of ***location of treatment*** as an attribute:

"I think the smartphone way is better in that sense" FG1, Female, age 16 or 17

"When you've got it, you got to find treatment so doesn't really affect your…" FG1, Female, age 16 or 17

"I'd rather go to a GP than have to go to a sexual health clinic because there's more stigma with a sexual health clinic whereas…" FG2, Male, 17

As a route to treatment one focus group highlighted the potential abuse of an online consultation:

"so you know where you have to answer questions in the app you, what if you lied, how would you…?" FG2, Female, 18

"but if there is someone there you are less likely to lie…" FG2, Female, 18

"yeah and I think people always misuse stuff like apps" FG2, Male, 17

No studies are thought to have published results specifically exploring preferences for where people attend for treatment once they have had a positive test result or how they access a healthcare professional for treatment outside of the studies exploring preferences for accessing sexual health services in general terms outlined previously.

Location of test (e.g. self-test at home, self-sample at home and send away for analysis, attend GP practice, attend sexual health clinic) was discussed and was seemed to be considered an attribute of lower importance through the discussions than ***location of treatment***, however through completing the ranking exercise as a group this was reversed. Within these discussions participants focused more on ***location of test*** as being the collection point for the test e.g. shops or ordering online, with the actual location that the test was undertaken garnering more discussion in connection with ***sample collection method***:

"I like that you have the option to order online as well because then I know some people might find it awkward to go to the shop and pick one up…" FG3, Male, 20

"I find it a bit embarrassing maybe going up to a shop and and picking up you know the test product that everyone would see what I'm you know, what I'm buying" FG4, Female, 21

Discussion took place within Focus Group 2 about the need to make STI testing kits more widely available to reduce the stigma associated with testing including suggestions of schools, youth centres and public toilets:

"…more commonplace like, if I saw like STI tests everywhere, I'd just be like oh yeah, there's another STI test…" FG2, Male, 17

Of the points made in respect of the location of where the test would be undertaken, Focus Group 2 highlighted an indication of a preference for remote testing over clinic based testing:

"We all know that if you go to the hospital you're in there for, bloody days just to have a blood test taken…" FG2, Female, 17

"…but I think it's, it's more comfortable I'd say, you can do it in your own home…" FG2, Female, 17

Finally, ***how you tell your partners*** was considered by the focus group participants as being of lower importance than the majority of other attributes in the discussions and it was ranked in the lower half of factors in the ranking exercise. The discussions highlighted mixed views on partner notification ranging from participants expressing a view that they should not be told via text, indicating a preference for telling partners face-to-face:

"Personally for me telling then over text is a lot worse than just seeing them it's like hey baby you've got syphilis" FG1, Male, 17

"It's not something you really want to say over text is it?" FG2, Female, 17

"Another thing like we looked at each other so funny when you can just send like your partner just like this…" FG2, Male, 17

"Can you imagine if you're out and you got that… you'd be like what's this? Oh my God…" FG2, Female, 17

With one participant acknowledging that the new eHealth service:

"…definitely removes the pressure from it especially if like going to tell a partner…" FG2, Male, 17

Whereas other participants acknowledged a preference for a clinician to notify their partners for them:

"I quite like the part where the doctor will tell… notify your partner about it that you don't have to tell your partner directly by yourself" FG4, Female, age unknown

"… I don't think it's quite a good idea to like tell your partner by yourself, it kind of, it doesn't give you choice to avoid those uneasy and… like you have to tell your partners yourself but in the previous scenario you can help from the advisors" FG4, Female, age unknown.

Apoola and colleagues identified that preferences for partner notification vary depending on whether the respondents viewed themselves as the index patient or a contact (Apoola et al., 2007). Gotz and colleagues identified that an online partner notification tool was particularly suited to patients who were notifying more than one partner (Gotz et al., 2014), while Mimiaga and colleagues noted a 'broad acceptance' of internet based partner notification (Mimiaga et al., 2008). However, Kerani and colleagues found that men were less likely to seek care than if they were notified by an e-card compared to direct notification (Kerani et al., 2013), and Shivasankar and colleagues noted a preference for traditional partner referral (Shivasankar et al., 2008).

Gursahaney and colleagues found that patient delivered partner notification was more successful where people were in established relationships (Gursahaney et al., 2011), a view indirectly supported by Jones and colleagues who identified that third party partner notification was preferred if the partner was a casual partner (Jones et al., 2013).

This completes the summary of the findings into participants' views on product/ service characteristics introduced into the focus groups by the facilitator, either through the vignettes or through the subsequent group questions. Of note is that participants did introduce two factors themselves that had not been identified by the facilitator prior to running the focus groups – ***data security*** **and** ***staff attitude***.

Data Security and aspects of it such as data sharing with other health services, and security on smartphones was raised by participants in all four focus groups. The issues ranged from the security of the app/eHealth clinic itself:

"I think there is always the risk of security of using smartphones and apps and that might not be an issue but it could be …" FG1, Female, 17

"I think like a really small thing about it is just the confidentiality aspect that like if someone's going through your phone, because I don't know if the app saves your erm answers or your results or if you do really want it to be confidential your friends might see it or something and…" FG4, Female, age unknown

to perceptions of a greater degree of confidentiality afforded by face-to-face and clinic services:

"… when you're talking to erm erm to someone personally and erm I and when you're in contact with them erm and you're sure that the information will be confidential…" FG3, Male, 24

"I think when someone don't want other people to know about them going to see the clinic they won't do it online, just everything's got a record and erm it's probably, I don't know, more dangerous, it's less confidential than the, it seems like less confidential than the clinic" FG4, Female, unknown

Three studies identified in the literature review identified confidentiality and privacy concerns to be a barrier to internet based chlamydia testing (Lorimer and McDaid, 2013, Hottes et al., 2012, Tomnay et al., 2014) however this is not highlighted as an issue in other studies where participants value the convenience of this service option (Greacen et al., 2013, Kwan et al., 2012, Novak and Karlsson, 2006, Shoveller et al., 2012).

Staff attitude was raised as an issue in one focus group, drawn from the personal reflections of participants who had either used testing services or accompanied friends to sexual health services:

"First impressions, I think counter staff, right, I just thought of this, when I got tested right, the first impression I had of the staff was so rude, like they they just didn't smile and make you feel welcoming or reassuring so I think that's a key little bit there which I would prefer" FG2, Male, 17

"…like I remember when my friend went to get the morning after pill and she was worried that she had an STI, erm and like the woman at the counter was like 'oh is this for you' and she made like really sarcastic comments and that really puts people off like, I think people who work in sexual health, should, like not that they're nasty but like everyone… should be more considerate" FG2, Male, 17

Staff attitude, for example, friendliness and empathy, has been identified as important in a number of studies (see, for example, Hambly and Luzzi (2006); Ingram and Salmon (2007); and Knapp and Anaya (2010)). Staff gender was also identified as an important factor in a study on sexual health service design in which young people ranked factors of importance (Jerome et al., 2009).

5.2.6.2 Category - User Impact

In understanding why participants placed importance on particular product/ service characteristics, their preference was considered in the context of their broader statements and the group discussion. This broadly fell into two themes related to impact – emotions, beliefs and perceptions (the emotional impact) and the tangible impact of testing (the user impact) Again, a matrix coding query was used to map frequency of codes falling into these themes. Starting with the emotional impact theme, ***worry*** was the emotion mentioned most frequently for making a choice in the consideration of the importance of an attribute in making a decision be that waiting for results (the most common), the range of STIs you get tested for or the 'fit' of a service to their personal circumstance:

"… and then you're waiting those seven days, I think it's just the worrying bit that would get to me, like worrying if you've got it what you do, how would you react and cope" FG2, Male, 17

"well obviously because I've been nagging on about it all night tonight, it would definitely be the time and the worrying…" FG2, Male, 17

"because if I was nervous about it I would want to know within 15 minutes not have to wait two weeks" FG3, Male, 20

"I'm more concerned about the overall time duration it's like you're never sure when you get the provisional results and you have to wait for the full report and you're constantly worrying about that for that time" FG4, Female, age unknown

"Well if you have symptoms then it might well make more sense for you to go a clinic whereas if you don't and you're just worried the internet one might make more sense…" FG3, Male, 18

"My worry would be that because it's not quite to my situation, or it might not be quite tailored to my situation it might be a bit wrong, then I'd get nervous…" FG2, Male, 17

Privacy was the most frequently cited reason for the desirability of a particular product/ service characteristic but was viewed by participants as a significant consideration in making a choice to use a service:

"But then you could argue if you're having it ordered to your house somebody might not like that because if someone else like sees it, whatever then… FG1, Female, 17

"you can get privacy as well, like I said before, if you are going into a, walking into a clinic you might not want someone to see you, some people don't like, feel like awkward, the might not want to speak to anyone about, like a nurse or a doctor so they might rather do it themselves" FG2, Female, 17

"… you get to kind of do everything almost anonymously like over the internet you kind of feel that you're anonymous so you kind of get to, you don't talk to another human being about it or whatever until you know you're positive so that kind of appeals to me a bit more." FG3, Male, 20

And also as a factor that they would be willing to trade in favour of another:

"… to be very honest erm all the people would like to keep it very private which makes it all the sense but then again when you're talking to someone, when you're talking erm talking to someone personally… and you're sure the information will be confidential I think it always feels better when you're suspecting that you have an STI… it always feels better to talk to someone" FG3, Male, 24

"So there's less privacy but maybe they know what they're doing better than you would if you were doing the test yourself so…" FG4, Female, 21

The desire for privacy was closely linked with ***embarrassment*** **and** ***perception of others***. Coding for ***embarrassment*** included consideration of situations described by participants as awkward, embarrassing, and feeling self-conscious. These encompassed participants' consideration of the whole pathway in general:

"It's also like more private and less embarrassing" FG1, Female, 17

"especially if you were embarrassed by it you didn't want to tell people you, you didn't want people to know where you were going or whatever, that's not the kind of thing, you can't do it as privately…" FG3, Male, 18

The ***embarrassment*** of talking to a healthcare professional about their sex life:

"If you've got to say to someone, if you're uncomfortable about talking about sex, you are going to say to someone when was the last time you had sex, and if you use protection, and whether they're your partner… That's a bit like, some people might feel uncomfortable doing that" FG2, Female, 17

"I can see how this could be very advantageous for people who are maybe a bit more embarrassed about talking to someone about their problems" FG4, Female, 21

The ***embarrassment*** of collecting a test:

> *"I find it a bit embarrassing maybe going up to a shop and picking up you know the test product that everyone would see what I'm you know, what I'm buying"* FG4, Female, 21

The awkwardness of what to tell your partner:

> *"Because even that length of time if you have a partner you don't really know what to tell them, do you wait until you got the result and that can be awkward too, and with the awkwardness…"* FG3, Male, 20

And seeing other people that you know:

> *"Yeah that's always awkward when you go in and you see someone you know and it's like oh dear…"* FG2, Female, 17

The ***perception of others*** was an issue highlighted in the first two focus groups. This was primarily centred on their peers and family, with one participant drawing a personal reflection on her testing experience:

> *"…I went once to get a test done and I saw like, just a girl that like I knew that got the bus with me and it's just one of them where you both look at each other and it's like 'oh I know why you're here' that is just one of them, like you don't, you don't really discuss it… but yeah it's quite a stigma around STIs"* FG2, Female, 17
>
> *"It might become clear in your workplace or at home and social life that clearly you're anxious because it's hard isn't it to think that you're going to forget for two weeks the fact that you send off a test for an STI"* FG1, Male, 16

A reflection on the perception of healthcare professionals was also offered, which was also reflected in the ***staff attitude*** sub-theme identified by Focus Group 2:

> *"And then if they had something they might think that they're going to be judged because they've…"* FG1, Female, 17

Stigma was singled out in Focus Group 2 as a factor impacting on choice, particularly in respect of ***perception of others*** and ***location of services***:

> *"There's kind of a stigma, like going to…"* FG2, Male, 17
>
> *"That's what you would need, that would take the stigma away, just having them everywhere…"* FG2 (in respect of testing kits), Female, 17
>
> *"because you can like choose to go where you want to go I'd rather go to a GP than have to go to a sexual health clinic because there's more stigma with a sexual health clinic whereas…"* FG2, Male, 17

In respect of the **'tangible user impacts'**, those factors associated with what is involved for the user, the biggest consideration that participants gave was to ***convenience*****,** however although a flavour of convenience featured in Focus Groups 1 and 2 it was only explicitly discussed in Focus Groups 3 and 4. This may be due to the age of the participants with the first two focus groups being comprised of 16 and 17 year olds, and 3 and 4 18-23 year olds. Within the explicit discussions on convenience these centred primarily on time:

> *"the good thing about this test is that it's, it doesn't take up a lot of my time, I can do it, I can get on with my life the next 14 days and then get it back…"* FG3, Male, 18
>
> *"… and of course the new service is very convenient, it is, it saves time, I think yes of course it saves time, I think of course it saves money…"* FG3, Male, 24

"I think I prefer online because it's very convenient, compared to the one like you have to go speak to the professional…" FG4, Female, age unknown

"I find the internet testing is like convenient because you can do yourself…" FG4, Female, 19

Convenience was also discussed in respect of location to a lesser extent:

"But also convenient because if it was in a nearby shop you can get it from there as well" FG3, Male, 18

"One thing I like about this is, is the time flexibility you can order a test and just post like mail it to the erm testing centre so it gives you choice on, you don't need to book any clinic appointment" FG4, Female, unknown

"…in terms of at least sexual health clinic, that works like so like if you're in a city you'll probably be, more closer to a clinic so that you can walk or something" FG4, Female, unknown

Little or no consideration was given to personal cost by the participants once it had been established that sexual health services within the NHS are free with one participant referencing that home-based tests would save on travel cost.

A summary of the findings of published studies in respect of the values, beliefs and perceptions which impact on the use of sexual health services is provided in section 4.3.5.

5.2.6.3 Category - Participant Questions - Understanding STIs and Sexual Health Services

The third and final category relates to the questions asked by participants in order to inform their thoughts and decisions as part of the focus groups. Of the 21 participants four had previously tested for an STI, with FG1 having no participant who had tested for an STI before. Whilst the vignettes provided a walk-through of the clinical pathways and an explanation of what would happen at each stage, participants asked a number of questions of the facilitator in order to seek more information before commenting.

Questions asked can be broadly split into three categories:

- Pathway clarification e.g. location of service, time, range of tests
- Test product based e.g. accuracy and reliability, time to result
- STI based e.g. symptoms, complications, whether curable or incurable

A presumed level of basic knowledge of STIs was assumed, given that it is a legal requirement that all schools in England have a sex and relationships education (SRE) policy, and that this covers the teaching of reproduction, sexuality and sexual health (Long, 2016).

The categories build on each other, starting with participant questions, to inform understanding and assessment of user impact, resulting in participants' preferences for product and service characteristics as illustrated in figure 5.4.

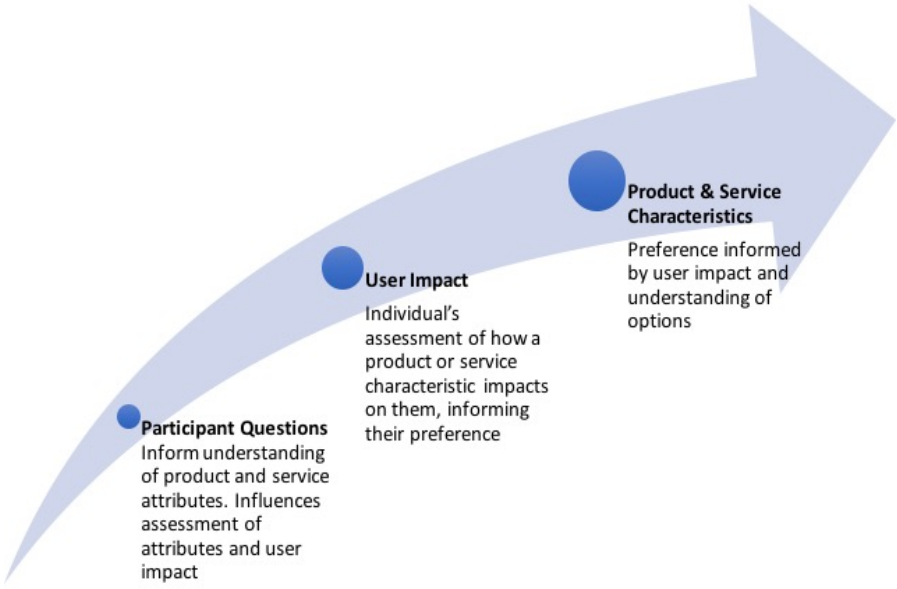

Figure 5.4 - Linkages between Themes

5.2.6.4 Ranking the Product/ Service Characteristics

The final data obtained from the focus group was a ranking exercise of the long list of potential product/ service characteristics. As outlined in more detail above in section 5.2.2.4, the decision to include this was as an enabler for discussion on the importance of characteristics. The level of engagement in the earlier focus group questions was not anticipated when designing them, which in part made this question less important as participants had outlined their views extensively in response to earlier questions. This in itself also made for much quicker progression through the ranking question, with the focus groups all completing the exercise in under eight minutes. The results are shown in table 5.6:

Rank	Product/ Service Characteristic	FG1	FG2	FG3	FG4	Total
1.	Range of STIs	3	2	1	3	9
2.	How long it takes to get result	1	3	5	5	14
3.	Sample Collection Method	7	1	3	8	19
4.	Accuracy	6	6	7	1	20
4.	Access to HCP (Result & Treatment)	4	5	2	9	20
6.	Treatment Consultation Method	5	4	9	4	22
7.	Knowledge of HCP	2	12	11	2	27
8.	Where you do the test	11	8	6	6	31
9.	How you tell partners	10	7	8	7	32
9.	Where you go to get treatment	8	10	4	10	32
11.	Type of HCP	9	11	10	12	42
12.	How you find out result	12	9	12	11	44

Table 5.6 - Results from Focus Group Ranking Question

Characteristics were ranked from one to twelve, with one being the characteristic of most importance. The results are presented in the table in the order of importance, with the lowest total score being the characteristic of most importance across the four focus groups.

It is important to note the limitations of the ranking question. The participants in each focus group took a slightly different approach in organising themselves to answer the question and how they selected the final order. FG1 and FG3 had a clearly identified order of selection, with the exception of FG1 where, on analysing the recording afterwards, it was not clear on the order of the third and fourth most important characteristic. FG2 grouped the characteristics into three groups – a bottom four, middle four and top four, the ranking of the top four is clear but the order in the middle and bottom four characteristics less clear, the order given in the table being as close to identifiable from the recording.

FG4 discounted characteristics in order, but not necessarily order of priority, with their discussion of the card presented to them leading to the characteristic being discarded but not necessarily with consideration to its relative importance to other characteristics.

5.2.7 Discussion

Results from the focus groups provided an extremely rich source of information. The themes identified from the thematic analysis of the data provided an innovative method of supporting the DCE development incorporating the respondent perspective on a number of levels:

- Providing insight into young people's knowledge of STIs and what services are available to them. This helped shape the background information provided alongside the DCE.
- Gathering information on what is important to young people in making a decision on whether to test for an STI and how to get treatment both in terms of attributes and potential levels.
- Understanding how their emotions, values and beliefs influence their decision-making.

One strength of the novel approach used in this research is the new knowledge that it contributes in respect of young people's views on the technological advances that are feasible in the next 3-5 years. These include self-testing via a mobile phone, online consultation for chlamydia and an alternative method of partner notification. It also provides this within the context of a whole STI testing and treatment pathway as opposed to the current published studies that predominantly explore one aspect of a new technology e.g. self-testing or online partner notification.

Another valuable aspect of this research is that the study has been undertaken with young people, rather than 'service users', including providing views from the broader population who have not previously used STI testing services. This is particularly important given that uptake by young people is the key factor in diagnosing and treating STIs for reducing transmission rates and preventing long term complications.

The findings of the focus group study support the overall general direction proposed in both general health policy and the national strategy for sexual health that seek to incorporate technological advances into service delivery, this was demonstrated through the expression of support for remote testing options. However, the focus groups did not wholly embrace all of the options, most notably, non-face-to-face options for accessing a healthcare professional.

The research has some limitations which are important to note. The first is that convenience sampling was used to recruit the focus group participants. The impact that this might have on the validity and generalizability and the steps taken to limit this impact have been described in section 5.2.2. The second is that only the author was present in the focus groups and her primary focus was the facilitation of the group. Whilst it was important for the author to demonstrate her competence as a researcher and no verbal communication was lost owing to the focus groups being recorded, not all non-verbal group interactions were recorded. This links to the following point regarding pre-existing and self-selected groups as considerably more non-verbal communication was noted within the pre-existing groups than the self-selected groups.

However, the opportunity to capture this fully was not possible. Reflecting on the non-verbal communication observed it is not believed that a detailed recording of the non-verbal communication would have affected the findings however, its incorporation may have enhanced the reflection of the degree of agreement or disagreement within the group.

The recruitment of participants from pre-existing groups as well as focus groups with participants who were not known to one another, provided the researcher with an opportunity to experience and consider the juxtaposed views of Krueger and Kitzinger on the impact of running the focus groups and the information gained from them. Freeman points to Krueger's critical view of the use of convenience samples and pre-existing groups due to the impact of the pre-established dynamics which he believes are problematic for analysis and the consequences for external validity (Freeman, 2006). This is in contrast with Kitzinger's view that pre-existing groups offer a valid way to explore topics "friends and colleagues can relate to each other's comments to incidents in their shared daily lives. They may challenge each other on contradictions between what they profess to believe and how they actually behave" (Kitzinger, 1995:300).

A number of key differences were observed by the researcher between the pre-existing and self-selected groups. Firstly, the flow of discussion was significantly different within the two group types.

Within the pre-existing groups there was 'banter' between participants and they would pick up on comments made by others and continue to the point or offer a different point of view. The discussion became more tangential than the self-selected groups with the facilitator needing to redirect back onto topic on a small number of occasions. Within the self-selected groups the interaction was very different, participants spoke in turn, they expressed their views however did not query or link them directly to other participants' views very often.

This impacted on the role of the facilitator greatly in terms of providing the acknowledgement and/ or feedback to the group participants. This contrasted with the experience in the pre-existing groups where the facilitator felt much more pulled by the group into their discussions as they actively sought to engage the facilitator in their discussions on a number of occasions. Reflecting on the process, whilst very different, both types of group yielded significant information on the participants' views of sexual health services.

This section reported on the methods used and results obtained from the focus groups. The main themes have been set out and discussed in relation to young people's view of different ways of accessing sexual health services for the testing and treatment of STIs. The next section takes forward the selection of attributes and levels for the DCE by using the results from the focus groups to inform the development of the expert groups.

5.3 Consultation with Expert Groups

The need to "strike a balance between what may be important to the respondent and what is relevant to the particular policy or decision making environment" is identified by Bridges and colleagues as a key consideration in the identification of attributes (Bridges et al., 2011). Expert groups were selected as the method by which the findings from the focus groups with young people (the respondents) could be explored with a range of professionals with expert knowledge of the policy, service development or technology context.

5.3.1 Expert Group Objectives

The objectives of the expert groups were to consider whether:

- The potential attributes met best practice requirements as defined by ISPOR Conjoint Analysis working group (Bridges et al., 2011) as "a subset of all possible attributes can be determined on the basis of three criteria:
    - Relevance to the research question;
    - Relevance to the decision context;
    - Whether attributes are related to one another" (Bridges et al., 2011:406);
- Any key attributes omitted that may lead response bias;
- Levels are sufficiently reflective of current and potential future technology developments.

5.3.2 Methods

Consideration was given to the range of methods available for seeking expert opinion including consensus methods such as the Delphi technique and nominal group technique (Bowling, 2009). However, following discussions with supervisors the author determined that running the expert group as a focus group would best deliver the objectives by enabling discussion around a series of key questions "in a focused discussion to help understand the topic" (Krueger, 1994:10).

In designing the expert groups consideration was given to the methods outlined previously and the topic guide was structured to provide an overview of:

- The purpose of the study,
- Key features of the DCE method,
- The research undertaken to date and findings (literature review & focus groups),
- Proposed attributes based on focus group findings and rationale for selection and de-selection,
- Proposed levels based on focus group findings and literature.

This overview was provided in an information pack at the start of the group by the facilitator and then each attribute was considered in turn against the objectives outlined.

5.3.3 Recruitment

The initial planned expert group included experts drawn from the eSTI^2 research programme and research experts with knowledge of the whole eSTI^2 clinical care pathway.

However, following the first expert group which consisted of sexual health clinicians and nurses, an epidemiologist and qualitative sexual health researcher, two issues were identified that warranted further consideration:

- The technical components of the test were key attributes identified by the focus groups which required more specialist input to inform the definition of the attribute and the levels;
- The eSTI^2 experts have a strong knowledge of the pathway development however it was considered that the selection of levels in particular may vary when considered by experts who do not have direct involvement in eSexual Health.

In order to address this three further 'expert groups' were run with:

- Technology developers (engineering and human technology interaction) from eSTI^2 focused specifically on the test related attributes;
- Test developers (microbiology) from eSTI^2 focused specifically on test related attributes;
- Sexual health researchers and clinicians affiliated with the SASH group at Coventry University and Coventry & Warwickshire Partnership NHS Trust.

5.3.4 Practicalities of Running the Expert Groups

In all cases the groups were run at locations convenient to the participants. The data provided by the expert groups was noted by the facilitator against the attributes discussed and a summary of the key points raised was circulated to participants for their confirmation that it accurately reflected their views.

5.3.5 Data Analysis

The key issues raised by each of the expert groups were summarised by attribute using a matrix. The expert groups were not recorded, fully transcribed or analysed thematically as their purpose was to build on the outputs of the focus groups and capture the salient points for consideration, which was achievable through the matrix coding.

5.3.6 Findings

A summary of the key points and consensus from the expert groups is included in table 5.17, summarised against each of the attributes discussed with the focus groups. It should be noted that not all attributes were commented on by all expert groups, this was driven by the participants themselves who did not feel able to comment on the attribute as it was outside of their area of expertise.

Attribute	Expert Group 1	Expert Group 2	Expert Group 3	Expert Group 4
Range of STIs	Problematic to define levels – NHS driven by clinically appropriate testing Differences between curable and incurable STIs – e.g. chlamydia and HIV – if thinking about HIV when completing DCE answers could be very different to chlamydia Consider excluding as attribute but acknowledging in introduction		Perception of risk relative to other STIs – a DCE focused on one STI is the best way forward otherwise the unknown associated with what people are thinking in terms of outcome is going to impact conclusions Methodological approach – could ask people in advance e.g. 'tick box to indicate which STI you are thinking of'	Problematic if exploring multiple STIs because of difference in test performance characteristics, particularly accuracy
How you do the test	Should there be a split between where I get the test and where I do the test? Potentially huge number of levels if full recognition of current pathways and plausible future options with POC and self-testing. Should scope be limited – focus on remote testing options? Will always be plurality of provision. Greater value to commissioners and policy makers to look at impact on realistic range of options	Estimate of 5-10 years for NAATs test at home – not possible at present due to accuracy POCT in the community more imminent – at least one company close to delivering this	Pharmacy currently more for treatment than test Primary care – pharmacy doesn't know individual whereas GP does Collection of test – consider in introduction rather than as attribute	Need to make HCP presence/ absence at sampling stage clear Self-test/ self-sample and post fundamental to remote models New POCT scenarios e.g. take sample to pharmacy Where you get the test from – need to clarify in definition of levels

Attribute	Expert Group 1	Expert Group 2	Expert Group 3	Expert Group 4
	Ensure clarity of definition between self-sampling and self-testing			
Time to Result	Consensus should be included but verify levels with WS2 and WS3 experts	15 mins will be an absolute minimum but 30 mins is more realistic for NAATs – sample preparation 10mins, amplification 15 mins	INSTI (HIV) delivers an antibody result in 3mins Consider whether 14 days is too long given other options – consider 1 or 2-day option Dean St Express – check time to result – possibly ½ day	Fastest NAATs POCT/ Self-Test is likely to be 30 mins Consider reducing 14 days as this is now normally achieved for NCSP tests
Accuracy (False Negative Rate)	Consensus should be included as attribute Tension between public perception of accuracy articulated through focus groups as false negatives versus clinical/ policy impact of false positive. Testing guidelines consider both Consider two attributes PPV/NPV or sensitivity/ specificity Level input from WS3 experts	Test is more likely to produce a false positive Two separate attributes for accuracy e.g. sensitivity/ specificity or false positive/ false negative would not make a difference from a test development perspective in terms of what people prefer	Framing of accuracy – need for reassurance Check current NHS position on test standards Impact on relationships of incorrect results Need to ground in range	Would not add value to have false positive rate as attribute from a test development perspective Understand how accuracy is valued as a preference relative to others – reflection on example of other DCEs for cancer testing with strong focus on test characteristics.

Attribute	Expert Group 1	Expert Group 2	Expert Group 3	Expert Group 4
Knowledge of HCP	Concern regarding how this could be articulated in levels – its inclusion does not add value Difference between knowledge and competence General agreement a better option is to recognise importance to people – treat as constant across all options through introduction		Issue with the term specialist knowledge – how to convey meaning Specialist health service v's other General agreement should hold constant in introduction	Preferences may vary in different part of the pathway and for different STIs General agreement to hold constant within questionnaire
Access to HCP	Consensus amongst group that this attribute should be included given use of digital technologies as an alternative to face-to-face in current policy Issue of access before/ after result – qualitative research has shown differences in preferences – split attribute?		Consensus amongst group should include as number of technologies can be used as an alternative to face-to-face contact with a clinician Could frame differently e.g. face-to-face, remote or synchronous, non-synchronous	Time information required
How you get Treatment for Chlamydia	Overlap between how you access HCP and how you get treatment in proposed levels. Split attribute – how you get treatment/ how you get antibiotics?		Are they important relative to others? Could explore collection point e.g. delivery to a locker	Need to separate consultation and collection of antibiotics, issue of postal treatment potentially worth exploring

Attribute	Expert Group 1	Expert Group 2	Expert Group 3	Expert Group 4
	Current issue owing to private providers posting non-compliant NG treatment to positive patients Postal treatment option for some STIs e.g. chlamydia.			Potential long term issue with single dose Azithromycin as treatment for Chlamydia due to antimicrobial resistance however no current planned change to treatment regime
Staff Attitudes	Consensus to exclude – will not provide useful information from DCE		Consensus to exclude	
Data Security	Consensus to exclude however assurance required in introduction to treat as constant		Consensus to exclude	

Table 5.7 - Summary of Key Points from Expert Groups

5.3.7 Discussion

Reflecting on the need to balance what is important to young people and the policy/ decision making context the expert groups have introduced some different perspectives on a number of attributes. The range of tests undertaken is the most significant difference between the focus groups with young people and the expert groups. The focus groups indicated that there is a strong desire to be tested for 'everything' whereas the expert groups indicated that this will never happen. This is clinically driven in that the range of tests requested by clinicians is determined according to patient risk factors, and the high risk of false positive results in low prevalence STIs.

Another dimension which came to the forefront in the first expert group was the impact of the STI being considered when completing the DCE. Given the variation between STIs from chlamydia, which once diagnosed is treatable with a single course of antibiotics, to HIV, which is currently incurable, participants in the expert groups believed that this may be a significant factor in which levels individuals express preferences for, for example the method by which they get their results – phone, email, text or face-to-face. Whilst this was not explicitly discussed in any of the focus groups there was some evidence of participants considering this:

"I think what you're getting tested for cos even though those two do chlamydia and gonorrhoea the fact that HIV is the worst one in that you've got it for the rest of your life and that isn't getting tested in either of these I think is quite bad…" FG2, Female, 17

"Or does it depend how serious it is though like… because if it's serious then I'd rather have a phone call than a text" FG1, Female, 17

"It would be quite, I don't know serious, as to get a text to say you've got HIV or you're HIV positive" FG1, Male, 16

Access to a healthcare professional is another attribute where there was a difference between the views of the young people and the expert groups. Whilst the young people generally regarded how you access a healthcare professional as an attribute of importance, the expert groups highlighted alternative access methods e.g. telephone, instant messaging and email consultations in particular feature highly in digital policy and current NHS practice for reducing face-to-face attendances.

Finally, the expert groups introduced consideration of a new attribute – how you get your antibiotic. Within the focus groups with young people, where you go to get treatment was considered e.g. GP, pharmacy etc., but not how you get your antibiotic e.g. collect from pharmacy or by post. Whilst this was not identified through the literature reviews undertaken to inform the long list of potential attributes, immediately prior to the expert groups it became a national media topic in England due to online sexual health services in the private sector offering sub-optimal (oral antibiotic) treatment for gonorrhoea. However, the use of postal treatment for chlamydia is feasible and safe, given that it is a single dose oral antibiotic. Therefore, to address the issue of overlap within the 'how you get treatment for chlamydia' attribute the first expert group proposed that exploring this as a separate attribute could be a useful addition as it could create the option for a fully remote pathway with self-testing and online consultation. This was not explored with the focus groups as part of the vignettes/ long list of attributes and was not an attribute they identified.

5.4 Selection of Attributes & Levels

The purpose of the focus and expert groups was to inform the selection of attributes and levels for the DCE. As highlighted in section 3.5.1 there are a number of key considerations that determine selection. Achieving a balance between attributes of importance to the study population and attributes which will deliver impact to services and technology developers was the key consideration in selection. This led to the decision that a formal ranking or consensus method should not be used with either the focus or expert groups as a combined view of both was required. Instead, the approach adopted was a narrative synthesis developed for implementation reviews to enable the outputs from the focus groups, expert groups and literature review to be synthesised against each potential attribute (Pope et al., 2007).

The approach adopted has been outlined in table 5.8 against the key elements of synthesis identified by Pope and colleagues:

Element of Synthesis	Approach Taken
Developing a Theoretical Model	Identification of a checklist of properties against which attributes can be considered to inform the selection process
Developing a Preliminary Synthesis	Tabulation against the checklist – to create a matrix of checklist criteria against attributes to enable visual comparison of perspective
Exploring Relationships in the Data	Conceptual mapping and triangulation against the checklist
Assessing the Robustness of the Synthesis Product	Critical reflection on the synthesis process

Table 5.8 - Summary of synthesis approach taken to inform the selection of attributes and levels. Adapted from Pope et al., 2007:108-111

5.4.1 Development of a Theoretical Model

In forming a checklist of properties against which the final selection of attributes and levels were determined, consideration was given to the methods and best practice suggested in the key texts summarised in section 3.6.1. The final checklist was determined to include the following:

- User views – focus groups with young people,
- Current Policy Context – derived from expert groups and background literature,
- Current Commissioning/ Service Delivery Context – derived from expert groups and background literature,
- Current/ known future technology development – derived from expert groups and background literature,
- DCE requirements for the selection of attributes and levels – ISPOR good practice checklist (Bridges et al., 2011), other publications on DCE methods (Ryan et al., 2008, Lancsar & Louviere, 2008).

5.4.2 Developing a Preliminary Synthesis

In order to synthesise the data a matrix was created summarising the key considerations against the checklist criteria. The detail underpinning the matrix has been articulated in other sections of the thesis and therefore is not replicated in full in this section:

- User views – focus groups and other studies – Sections 5.2.6, 4.2 and 4.3,
- Current Policy Context – Sections 5.3.6, 2.3.1 and 2.4.1,
- Current Commissioning/ Service Delivery Context – Sections 5.3.6, 2.4.2-2.4.4,
- Current/ known future technology development – Section 5.3.6, 2.3.2-2.3.3, 2.4.5-2.4.6,
- DCE requirements for the selection of attributes and levels – Section 5.1.

An extract for one attribute is provided in table 5.9:

Attribute	Young People's Perspective	Policy Context	Commissioning/ Service Delivery Context	Technology Context	DCE Design Requirements
Access to Healthcare Professional	• Highlighted overlap in interpretation of attributes particularly access to HCP and treatment consultation method. • Focusing on views on access methods, clear expression of views from participants on preference for face to face over non-face to face but differing views between individuals	• Digital First (2012) – high impact digital initiatives include online/ remote consultation • Five Year Forward View (2014) – commitment to expanding the use of digital technology • Framework for sexual health improvement in England (2013) – recognises need to support self-care including use of mobile technology and smartphone apps for STI testing	• Alternatives to face-to-face have demonstrated service efficiencies in other specialties • Non-face-to-face solutions may increase uptake given known barrier of stigma with access to sexual health services	• Growth of use of alternatives to face-to-face: • Video Consultation • Email • Online Consultation (e.g. WebGP) non-synchronous, private sector examples • Instant Message/ Live Chat – Brook pilot, Conifer online clinic • Telephone consultation widely used in primary and secondary care for certain conditions	• No overlap between attributes • Clear definition of attributes and levels • If attribute not included will need to be 'held constant' in background information

Table 5.9 - Example from Preliminary Synthesis Matrix

5.4.3 Exploring Relationships in the Data

Once created, the preliminary data synthesis matrices were reviewed several times and a number of issues and themes emerged from this process that were of particular significance in the selection of the attributes and levels:

- Overlap between attributes perceived by young people participating in the focus groups,
- Generation of high numbers of implausible combinations of attributes,
- Generation of high numbers of levels for an attribute.

Taking the data from the literature, focus groups and expert groups the author assessed the original long list of attributes used within the focus groups, and the additional ones identified by the focus groups and expert groups. Table 5.9 indicates the assessment of importance for inclusion as an attribute within the DCE relative to this evidence. This process also allowed for the consideration of the definition of attributes – in particular how they could be reshaped and merged, and whether/ how they should be incorporated into the background information presented to respondents prior to completion of the DCE.

Attribute	Young People (Service User)	Policy Perspective	Commissioning/ Service Devt	Technology Development	Notes
Sample collection method	~	×	✓	✓	FG participants linked closely with 'where you do the test' attribute. Not viable as individual attribute due to overlap.
Range of STIs tested for	✓	~	×	✓	Consistently in the top four in all four FGs. Experts view can only be clinically driven need to test rather than user driven want to test.
Where you do the test	~	✓	✓	~	FG participants linked closely with 'sample collection method' attribute. Not viable as individual attribute doe to overlap.
Time to result	✓	×	✓	✓	Considerable discussion within FGs, particularly willingness to trade for other attributes.
Test accuracy	✓	×	✓	✓	Variance in range of FG responses. Trust in NHS key factor. Expert views on accuracy from test development perspective.
Results notification	×	×	✓	~	Consistently identified as not important how FG participants get results as long as they get them.
Access to an HCP when you get your result	✓	✓	✓	×	
Treatment consultation method	~	✓	✓	✓	FG participants overlapped with 'where you go to get treatment' not viable as individual attribute.
Where you go to get treatment	~	✓	✓	~	FG participants overlapped with 'treatment consultation method' not viable as individual attribute.

Attribute	Young People (Service User)	Policy Perspective	Commissioning/ Service Devt	Technology Development	Notes
Partner notification method	×	×	✓	~	Experts felt although important health issue, area subject to significant research already. Minimal discussion within FGs.
Type of healthcare professional	~	×	✓	~	Consistently in bottom four responses in all 4 FGs. Some confusion between knowledge and type of HCP e.g. perception of knowledge linked to type.
Knowledge of healthcare professional	×	×	✓	×	Range of responses across FGs. Many factors contributing to discussion. Expert groups - inclusion of attribute will not shape service development.
Staff Attitude	~	✓	×	×	Preference expressed within one FG only. Output from DCE will not impact on service development as not controllable. 'You're Welcome' policy standards for young people's services.
Data Security	✓	✓	✓	✓	Importance recognised however minimum standard for NHS services specified. Including in DCE won't add value.
How you get antibiotics	~	×	✓	×	Not included within FG. Expert groups highlighted importance from service development perspective as allows for fully remote pathway.

Table 5.10 - Summary of Assessment of Attribute Importance.

Key: ✓ = high preference, × = low preference, ~= no clear preference expressed either way

5.4.4 Assessing the Robustness of the Synthesis Product

Pope and colleagues identify that in reflecting critically on the synthesis process this should include consideration of the:

"methods used (especially focusing on the limitations and their influence on the results); evidence used (quality, validity, generalizability) – with emphasis on the possible sources of bias and their potential influence on results of the synthesis; assumptions made; discrepancies and uncertainties identified; expected changes in technology and its effectiveness in real settings. Such a summary would enable the analysis of robustness to temper the synthesis of evidence as well as indicating how generalizable the synthesis might be" (Pope et al., 2007:111).

In considering the potential sources of bias and their influences on the results of the synthesis there are evidently a number of tensions in from the perspective of young people and the policy/ service perspectives articulated by the expert groups. The main source of potential bias is notably on the side of the experts who have an interest professionally in the development of the new technology and/ or the configuration of services, although there is a broader evidence base that can be drawn on from published policy and service data to contribute to this perspective. The young people participating in the focus groups offered their views within the structure of a focus group designed with questions to stimulate discussion on potential attributes, the questions did not lead the participants therefore the risk of bias was interpreted as lower.

The key influence in the synthesis of evidence was the perspective of the author. As outlined in section 3.1, the key driver is to add to the evidence base to inform decision making by commissioners and service leads on pathway redesign, therefore in making the final selection, the incorporation of attributes and levels which are realistic and meaningful to young people, but within the bounds of possibility for delivery within mainstream sexual health services was critical to the decision making. This is borne out in the summary of the rationale for the final selection of attributes and levels in the next sections.

5.4.5 Final Selection of Attributes and Levels

Resulting from the synthesis of evidence outlined in the previous section the final selection of attributes, and their revised definition is summarised in table 5.11.

Attribute	Definition
How you test for Chlamydia	This focuses on how you get your test, how the sample is taken and what happens to the sample once it's been taken.
Time to result	How long it takes to get the test result. For the self-test option, this is how long it takes from you doing the test to you being able to read the result. For the other options this is how long it takes from you posting or dropping off your sample to when you are given your result.
Accuracy	How accurate the test result is. Within the DCE the measure of accuracy used is false negative - the likelihood of the test telling you that you don't have Chlamydia when in fact you do
How you get your treatment (treatment consultation method)	If the test result is positive the options to get treatment for Chlamydia.
Access to HCP	How you contact the healthcare professional to complete your consultation, or in the case of the online consultation, accessing a healthcare professional for advice.

Attribute	Definition
How you get your antibiotics	The options available once the consultation has been completed to get antibiotic tablets.

Table 5.11 - Final Attributes Selected and Definitions

The rationale for the non-selection of attributes is summarised as follows:

- Range of tests – the concerns regarding the variance in preferences based on the STI being considered by the respondent was the primary reason for narrowing down the scope of the DCE to focus on one STI. Chlamydia was selected as it lends itself to the application of new technology along a fully remote pathway.
- Results notification and partner notification – high number of published studies in this area, of low importance to focus group participants. Results notification was held constant in the background information.
- Staff attitude and knowledge of HCP – no levels were defined that could produce useful information to inform service development.
- Data security – whilst this was recognised as important to all groups, levels could not be identified that could add value to inform service development given the NHS information governance standards set out the minimum acceptable levels of data security.
- Type of HCP – consistently considered of low importance relative to other attributes in the focus groups. This was in part picked up in the treatment consultation method as the options defined the HCP who would be involved in each level.

Attributes that are included but not in the form that was originally defined in the focus groups are:

- Sample collection method and where you do the test – combined into one attribute.
- Treatment consultation method, access to a healthcare professional and where you go to get treatment – redefined as two attributes recognising the overlap between the three attributes and that mainstream sexual health services would not offer an option where access to a healthcare professional was not available in the case of a positive result.

The previous sections have focused heavily on the selection of the attributes. Moving on to the selection of levels, it can be seen from the findings from the focus groups and expert groups that a number of potential levels have been identified. Table 5.12 summarises the potential levels drawn from the focus groups and expert groups, and those known from published literature and information.

Attribute	Potential Levels Identified from Focus Groups	Potential Levels Identified from Expert Groups	National Policy/ Clinical Guidelines
How you test for Chlamydia	• Order online • Collect from shop • Schools • Youth centres • Public toilets • Clinic	• Greater value to commissioners and policy makers to look at impact on realistic range of options	• Policy focus on remote/ self-testing • Increasing public health role of community pharmacy
Time to result	• Discussion centred on times proposed in vignettes i.e. 15mins, 7 days, 14 days	• Likely fastest NAATs self-test 30mins • Consider value of longer lengths e.g. 14 days • Dean St clinic – ½ day	• Cepheid GeneXpert – 90min processing time • GUM service specification – 7 days • NCSP turnaround time target – 14 days • NCSP turnaround audit
Accuracy	• 99% v's 95% accurate… if there's a larger difference then… • I don't mind 1 or 2% of difference	• Important to understand how accuracy is valued as a preference relative to others • Current performance standards used within NHS	• Test performance characteristics • False positive – 2% • False positive – 8% (lower 95% CI)
How you get your treatment (Treatment consultation method)	• Online/ Smartphone • GP • Sexual Health Clinic	• Separate consultation and how you get antibiotics	
Access to HCP	• Skype • Face-to-face • Phone • Internet	• Synchronous/ non-synchronous technology • Face-to-face/ remote	• Non face-to-face contact methods e.g. telephone/ video consultation

Attribute	Potential Levels Identified from Focus Groups	Potential Levels Identified from Expert Groups	National Policy/ Clinical Guidelines
How you get your antibiotics	• Not discussed	• Postal treatment options e.g. to home/ collection point • Current practice from pharmacy or sexual health clinic	

Table 5.12 - Potential Levels Identified from Focus Groups with Young People, Expert Groups and National Policy/ Clinical Guideline

The final selected levels and their rationale are included in table 5.13.

Attribute/ Level	Rationale
How you Test for Chlamydia	
Self-Test	Fully remote online pathway includes proposed self-test
Self-Sample and Post Off for Analysis	Current NCSP Internet Test Option
Self-Sample and Take to Pharmacy for Analysis	To explore enhanced role for community pharmacy beyond test distribution and treatment
Self-Sample and Take to Place of Education/ Work for Analysis	To explore suggestion from young people that testing should be more widely available, school was one of the suggested options
Attend GP Practice, sample taken by GP/ Nurse	Currently available option
Attend Sexual Health Clinic, sample taken by Doctor or Nurse	Currently available option
Time to Result	
30 Minutes	Suggested time for self-test NAATs from expert group
2 Hours	Based on Cepheid GeneXpert 90mins processing time plus additional time to setup
7 Days	GUM service specification standard
14 Days	NCSP Internet Testing Standard
Test Accuracy	
2 in 100 people will be told their test result is negative when they do have chlamydia	Based on false negative rate for Cepheid GeneXpert CT/NG Assay. Taken from FDA approval data
5 in 100 people will be told their test result is negative when they do have chlamydia	Based on false negative rate for BD ProbeTec CT Qx Amplified DNA assay. Taken from FDA approval data (note this was changed from 8 in 100 as a result of the cognitive testing)
How you get your Treatment	
Online Consultation	Fully remote online pathway treatment option
Pharmacist	Current treatment option
GP	Current treatment option
Sexual Health Clinic	Current treatment option
How you Contact a Health Care Professional	
Telephone	Current option
Instant Messaging	Current option in small number of cases
Email	Potential option
Face-to-Face	Current option
How you get your Antibiotics	
Deliver to Home Address	Potential option
Deliver to Collection Point	Potential option
Collect from Pharmacy	Current option
Collect from Sexual Health Clinic	Current option

Table 5.13 - Final Selection of Levels and Rationale for Selection

5.5 Discussion

Reflecting on the process undertaken to select the attributes and levels to take forward into the DCE, a key strength is the insight gained from the qualitative research undertaken with young people and experts to directly inform the selection. This is particularly relevant as, at the time this research was undertaken, there were no published studies looking at preferences for STI testing and treatment services which incorporated the novel technology being developed by eSTI^2 research consortium. A second strength of the research is the rigour which has been applied to the selection of attributes and levels, employing a number of research methods to distil a long list of potential attributes into the final selection for the study. Reflecting back on the methodological issues of concern in selecting attributes and levels outlined in section 4.1, care has been taken to minimise the risk associated with not achieving an appropriate balance between the policy/ service perspective and the user perspective by explicitly considering the breadth of views in the synthesis process. Attributes have developed from the 'long list', taking on board the findings from the focus groups with young people to clarify and shape in a way which reflected their understanding to minimise the risk of overlap between attributes.

The qualitative research process provided an opportunity to explore a range of issues associated with the inclusion of specific attributes and levels and how effectively they could be incorporated into a DCE. One of the key learning points stemmed from the consideration of the 'range of tests' potential attribute. It was identified as of considerable importance by young people in the focus groups, but on further exploration with the expert groups was highlighted as highly complex to incorporate into a DCE design looking at a detailed pathway. The synthesis process provided the opportunity to consolidate these views to provide an explicit process for selection/de-selection.

As highlighted in the literature review presented in section 4.2, the level of detail provided on the selection process is minimal and falls short of the suggested reporting checklist identified by Coast and colleagues (Coast et al., 2012).

The ISPOR good practice checklist for conjoint analysis suggests a number of methods for the selection of attributes and levels but does not endorse one approach (Bridges et al., 2011). One study (Miners et al., 2012) published the findings of the focus groups undertaken in order to inform the selection of attributes and levels (Llewellyn et al., 2012), however this did not include details of the process by which they were selected.

Exploring more widely, two studies have been identified publishing papers specifically on the process by which a long list of attributes and levels led to the final selection for a DCE. Both studies are from research in Malawi, the first (Abiiro et al., 2014) explored preferences for micro health insurance in Malawi. They used a literature review to inform qualitative data collection (through both qualitative interviews and focus groups), and subsequently used expert opinion to down-select attributes and levels, followed by piloting of the questionnaire. The second was to explore Malawian women's preferences for breast cancer screening (Kohler et al., 2015). The process adopted initially was similar to the approach taken in this research – literature reviews to inform a long list of potential attributes, the use of qualitative interviews with health care professionals and respondents, however the process for final selection differed, with dialogue between researchers and community outreach leaders using information from the interviews to determine the final selection of attributes and levels.

5.6 Summary

This chapter has presented the results of the focus groups with young people, expert groups and evidence synthesis to select the attributes and levels for the DCE. The focus groups provided considerable insight into the factors that are important to young people when making choices about testing and treatment for STIs and how their emotions, beliefs, experiences and perceptions influence their decision making.

The expert groups built on the findings of the focus groups and offered valuable real world insight into the policy and service context outlined in section 2.4. This was particularly helpful in identifying direct conflicts between what young people consider important e.g. a desire to be tested for 'everything' versus what is good clinical practice i.e. the use of national clinical guidelines on testing for STIs. Considering the outputs of both the focus groups and expert groups alongside the published policy, service and technology context in a narrative synthesis enabled the selection of attributes and levels which enable the design of a DCE rooted in the factors that are important to young people but realistic within the context of service delivery and feasible technology development.

This work has drawn out a number of key issues to be considered in the DCE design, which is taken forward in Chapter 6 including:

- The preparation of background information for participants to read prior to completion, in particular capturing the key elements identified in the focus groups to make explicit to avoid assumptions being made,
- The definition of attributes, levels and the situational context for them to ensure that respondents are clear what they are considering in making their choices,
- The management of implausible and illogical combinations.

CHAPTER 6 – DISCRETE CHOICE EXPERIMENT

6.1 Introduction

"Yeah the accuracy, it's erm, I don't mind 1 or 2% of difference but because erm this is convenient you get the results within 15 minutes, but the rest is like a week or two..." FG4, Female, age unknown

The focus groups presented in Chapter 5 provided a rich source of data into the views of young people on what is important to them when considering testing and treatment for STIs which, when synthesised with the views of experts and other service/ policy considerations, has informed the selection of attributes and levels to take forward in this DCE.

A benefit of the DCE method is that it enables insight into the respondent's strength of preference for attributes and levels relative to each other. Coupled with the robust process undertaken to select attributes and levels it was hoped that this DCE would provide new evidence to inform the design and development of new technologies and pathways for the testing and treatment of chlamydia.

This chapter builds on the selection of attributes and levels to include in the DCE outlined in Chapter 5 and presents the design, development and findings from the DCE itself including the:

- Methods used to design and undertake the DCE,
- Cognitive testing of the DCE questionnaire,
- Data collection and results,
- Discussion of the findings.

6.2 Methods – Questionnaire Design

There are numerous texts focusing specifically on the design and analysis of DCE questionnaires within a healthcare context (Ryan et al., 2008, McIntosh et al., 2010, Lancsar and Louviere, 2008, Ryan et al., 2014) and reports from three ISPOR special interest groups: one exploring good practice in the application of conjoint analysis in healthcare (which they note as equally applicable to DCEs), the second exploring the construction of experimental designs for DCEs, and the third considering statistical methods for the analysis of DCEs (Bridges et al., 2011, Johnson et al., 2013, Hauber et al., 2016). The following sections outline the methodological considerations and decisions taken in respect of the DCE experimental design, structured against the ISPOR good practice checklist (Bridges et al., 2011).

6.2.1 Methodological Considerations prior to Design

Ryan and colleagues, and Bridges and colleagues identified the following methodological considerations which should be addressed prior to the design of a DCE in a healthcare context (Bridges et al., 2011, Ryan et al., 2014). These are considered in the following sections:

- Choice context – labelled v's generic experiment
- Main effects with or without interaction effects
- Number and range of levels
- Full or partial profiles
- Number of profiles
- Opt out or status quo options.

6.2.1.1 Choice Context – Labelled v's Generic Experiment

Choices can be labelled e.g. GP, sexual health clinics, or through generic labelling e.g. choice A, choice B. The benefits of labels are that they offer context and therefore potentially reduce the cognitive burden for respondents. However, the key risk is that respondents focus on the labels and do not give due consideration to the attributes when making their choice (Ryan et al., 2008). For this survey a generic design has been chosen. The rationale was that labels are most commonly used where there is likely to be a strong preference for a brand, or when one of the objectives is to capture market share predictions (Ryan et al., 2014). Whilst the fully remote online pathway itself could be isolated and treated as a brand, the focus of the DCE is to understand the component attributes of importance to young people rather than the pathway per se. This approach will enable consideration of both a fully remote online pathway as a 'standalone' pathway and its possible integration into existing care pathways.

6.2.1.2 Main Effects with or without Interaction Effects

Main effects can be defined as the "effects of each attribute" whilst interaction effects explore the "effect of interaction between two or more attributes" (Lancsar and Louviere, 2008:26). Ryan and colleagues note that interaction effects are a significant constraint on the design, and in practice account for minimal variation in choices (Ryan et al., 2014). Studies exploring main effects only are the most common practice within published DCE studies in the health care context, with a recent systematic review finding that (where reported) 74% of studies published between 1990-2000 used a main effects design (Clark et al., 2014).

This increased to 89% in 2001-2008, and reduced to 54% 2009-2012. In contrast only 13% of studies published between 2009 and 2012 explored main and interaction effects, whilst only 6% of studies published between 2001 and 2008 explored them (Clark et al., 2014).

The research question explored in this chapter, namely 'which attributes influence young people's preferences for testing and treatment for chlamydia?' can be answered through a main effects design. It was decided to exclude interaction effects because they are not the primary focus of the research question, the complexity of the selection of interaction effects to explore, and the subsequent design of a study to incorporate these.

6.2.1.3 Number of Levels and Range of Levels

Ryan and colleagues note that that the number of levels per attribute depends on the type of attribute (categorical, continuous or probability) (Ryan et al., 2014), whilst Bridges and colleagues suggest that it is good practice to have no more than 3-4 levels per attribute (Bridges et al., 2011). Ryan and colleagues also note that from both a psychological perspective and a technical design perspective it is beneficial to use the same number of levels for every attribute (Ryan et al., 2014).

The selection of levels for this study has been informed by a rigorous qualitative research process resulting in the synthesis of findings from focus groups with young people and expert groups. It was not possible to achieve a design with the same number of levels for every attribute owing to the variation between attributes in the number of plausible levels and the perceived impact of their selection and de-selection as discussed previously in section 5.5.

Steps taken to mitigate the risks associated with differing numbers of levels per attribute are discussed further in the following sections.

6.2.1.4 Full or Partial Profiles

Full profiles comprise all of the attributes which are included in the study whereas partial profiles include a subset only. It is acknowledged that it is recognised good practice within healthcare research to use full profiles. However, it is necessary to understand whether respondents are able to "reasonably evaluate the full profiles" (Bridges et al., 2011:407). Alternatives to full profiles include partial profiles, or full profiles with overlap, that is, a number of attribute levels are the same in both choice sets (ibid.).

The DCE has been designed using full profiles, that is including all attributes being considered within the study. The cognitive testing phase of the questionnaire development incorporated questions to evaluate the cognitive burden of questionnaire completion and whether respondents were able to consider the breadth of attributes when making choices.

6.2.1.5 Number of Profiles and Opt Out Option

There are a number of different options to constructing the choice tasks within a DCE. These include:

- Binary choice (one option to which people respond yes or no)
- Pairwise choice (two options to choose between)
- Multiple choice (more than two options to choose between). This could include making one choice from a number of profiles, or selecting the best and worst from a range of choices or ranking a range of choices (Lancsar and Louviere, 2008, Bridges et al., 2011).

Bridges and colleagues highlighted the absence of research in the health care context on the impact of increasing the number of choices available to respondents within a task (Bridges et al., 2011).

A pairwise choice (option A and B) with opt out question was selected for the questionnaire design. This was selected over the other choice designs outlined above because of the risk of social desirability bias. Chlamydia is a significant public health issue and in providing respondents with background information to enable them to complete the questionnaire there was a possibility that respondents would answer yes to all questions in a binary choice design. Social desirability bias has been widely documented in respect of surveys exploring lifestyle behaviours and sensitive topics including drug misuse, sexual behaviour, voting, alcohol and tobacco use, unintentional injuries, violence diet and physical activity (Tourangeau and Yan, 2007, Brener et al., 2003). Brener and colleagues' literature review exploring factors affecting the validity of self-reported health risk behaviours identified that "Because unprotected intercourse is a leading cause of HIV infection, it is possible that people's responses are also influenced by fear of disapproval and informal social sanctions" (Brener et al., 2003:452). Whilst the DCE explores preferences rather than actual behaviours, a pairwise choice design mitigates the risk of social desirability bias through presenting two different choices for respondents to select from.

An opt out question allows the respondent to not choose one of the options within the choice set. This can be used to represent a number of options including choices for no treatment, no preference or current treatment (Bridges et al., 2011). They note that they can be "useful, or even necessary, if researchers are assessing the potential demand or market share of a (novel) product" (Bridges et al., 2001:407). Ryan and colleagues note that it "improves the behavioural realism of tasks" (Ryan et al., 2014:126); however, it can "decrease the cognitive difficulty of the task" (ibid). In the real world the decision to test or not test lies with the individual as does the decision to seek treatment if the test result is positive.

To force a choice between two options will limit the applicability of the findings in a real-world context because in the real-world people will always have the choice to not test. Therefore, the decision was taken to include an opt out option of 'I would not test' and the impact of this was explored through the cognitive testing of the questionnaire.

6.2.2 Experimental Design

In order to design the questionnaire, consideration was given to the management of a number of issues within the design type. Bridges and colleagues recognise that there is "no gold standard for experimental design" (Bridges et al 2011:408) and propose a range of criteria for evaluating designs including:

- "Efficiency Score
- Correlations among attribute levels
- Correlations among attribute level differences
- Level balance
- Number of overlapping attributes
- Restrictions on implausible combinations
- Cognitive difficulty" (Bridges et al 2011:408).

A summary of the DCE design developed for this chapter against these criteria is provided in table 6.1, and the rationale for the design choice is set out in the following sections.

Design Criteria	Summary of DCE Design for this Research
Efficiency Score	Initial D-Efficiency score computed by JMP Pro 9.2.0 of 98.06. Statistical efficiency was reduced in favour of response efficiency to remove implausible combinations.
Correlations among attribute levels/ attribute level differences	Correlation matrices used to check correlation coefficients and level balance as part of design process.
Level balance	Initial design achieved level balance across 4 of the 6 attributes.
Number of overlapping attributes	Minimal overlap on the 'time to result' attribute. Overlap introduced as a result of removal of implausible combinations.
Restrictions on implausible combinations	Implausible combinations (relating to how you test and time to result) were removed. Improbable combinations remained.
Cognitive Difficulty	Assessed through cognitive testing.

Table 6.1 - Summary of DCE Design Criteria

The six attributes and 24 levels adopted in this study are summarised in table 6.2. SAS 9.4 was used to explore the design options. Using the '%mktruns' macro it was identified that a full factorial design (all possible combinations of attribute levels) has 3,072 possible alternatives. This is not manageable in practice for participants to complete, therefore a fractional factorial design (FrFD) (a subset of all possible combinations of attribute levels) was selected.

Ryan and colleagues note that FrFD needs to satisfy two key design principles – orthogonality "The attributes are said to be independent (or orthogonal), meaning that the main effects of one attribute is not polluted by the main effects of another attribute" (Ryan et al 2014:105), and level balance – each level appears the same number of times within the survey.

Attribute / Level	A1. How you Test	A2. Time to Result	A3. Accuracy	A4. Consultation Method	A5. Access to HCP	A6. How you get Antibiotics
L1.	Self-test	30 mins	2 in 100 (False Negative)	Online	Phone	Post to Home
L2.	Self-Sample & Post	2 Hours	5 in 100 (False Negative)	Pharmacy	IM	Post to Collection Point
L3.	Self- Sample & Pharmacy	7 Days		GP	Email	Collect from Pharmacy
L4.	Self-Sample & Education/ Work	14 Days		Sexual Health Clinic	Face to Face	Collect from Sexual Health Clinic
L5.	GP Practice					
L6.	Sexual Health Clinic					

Table 6.2 - Summary of attributes and levels included in this study

The output of the %mktruns macro identified that the smallest 100% efficient design could be created with 48 choice sets (see Appendix 12). Recognising that 48 choice sets were likely to be too many for participants to complete, the questionnaire needed to be blocked (divided up into smaller questionnaires). Forty-eight choice sets can be blocked into two questionnaires with 24 sets, three questionnaires of 16 sets, or four questionnaires of 12 sets. It was decided to undertake the cognitive testing based on two questionnaires of 24 sets. The findings of the cognitive testing, discussed further in section 6.3.1, identified that a study based two questionnaires with 24 choice sets was acceptable to participants.

Johnson and colleagues note that designs "may deviate from strict orthogonality because of constraints placed on implausible combinations, lack of balance, or repetition of particular attribute levels across a set of alternatives (overlap)" (Johnson et al 2013:8). The outputs for the optimum questionnaire design identified in SAS 9.4 were used to compute the design in SAS JMP Pro 11.2.0. The choice design module within design of experiments module was used to create the questionnaire design. Thirty questionnaire design runs were completed and the design with the highest number of levels balanced across both questionnaire blocks (Design 11) was selected manually.

6.2.2.1 Implausible and Unlikely Combinations

Implausible combinations are defined as the circumstances which are not feasible or realistic in terms of either the situation or the outcome. These are important considerations in questionnaire design because of the consequences of how respondents view them when completing the questionnaire, including misinterpretation or hypothetical bias (Johnson et al., 2013).

Implausible combinations are one of the reasons suggested by Johnson and colleagues where it is appropriate to trade statistical efficiency for response efficiency (ibid.).

Reviewing the attributes and levels outlined in table 6.2 four implausible combinations were identified:

- Attribute 1, Level 1 – Self-Test, with Attribute 2, Level 3 – 7 Days
- Attribute 1, Level 1 – Self-Test, with Attribute 2, Level 4 – 14 Days
- Attribute 1, Level 2 – Self-Sample & Post off for Analysis, with Attribute 2, Level 1 – 30 mins
- Attribute 1, Level 2 – Self-Sample & Post off for Analysis, with Attribute 2, Level 1 – 2 hours.

There are a number of unlikely combinations, for example:

- Consultation Method – Pharmacy
- Access to a HCP – Face to Face
- How you get your antibiotics – collect from sexual health clinic.

Whilst the latter example is feasible (setting aside the contractual arrangements for drug dispensing), it is unlikely in reality that a person attending a pharmacy for a consultation would then go to a second location to get their antibiotics when they could be dispensed by the pharmacist. Both implausible and unlikely combinations were included in the cognitive testing (pilot phase). This identified that implausible combinations did impact on completion of the task whilst unlikely combinations did not. This is discussed further in section 6.3.1.

Implausible combinations were removed manually by switching as outlined in table 6.3:

Combination	Changed to
A1 L1, A2 L3 (Self-Test, Time to Result 7 Days)	A1 L1, A2 L2 (Self-Test, Time to Result 2 Hours)
A1 L1, A2 L4 (Self-Test, Time to Result 14 Days)	A1 L1, A2 L1 (Self-Test, Time to Result 30 Mins)
A1 L2, A2 L1 (Self-Sample & Post, Time to Result 30 mins)	A1 L2, A2 L4 (Self-Sample & Post, Time to Result 14 Days)
A1 L2, A2 L2 (Self-Sample & Post, Time to Result 2 Hours)	A1 L2, A2 L3 (Self-Sample & Post, Time to Result 7 Days)

Table 6.3 - Management of Implausible Combinations

Switching the implausible combinations as above creates one choice which is repeated twice within the choice sets of block 1: option A in choice set 8 and option B in choice set 20. However, there were no duplicate choice sets.

6.2.2.2 *Orthogonality and Level Balance*

The design created by SAS JMP Pro 9.2.0 achieved level balance across four of the six attributes as shown in table 6.4:

Attribute / Level	A1	A2	A3	A4	A5	A6
L1	16	24	48	23	24	24
L2	16	24	48	25	24	24
L3	17	24		25	24	24
L4	16	24		23	24	24
L5	15					
L6	16					
Total	96	96	96	96	96	96

Table 6.4 - Level Balance within Questionnaire Design Prior to Removal of Implausible Combinations

It did not generate a fully balanced design. Using the 'Evaluate Design' function within JMP Pro 9.2.0, the design diagnostics indicated a D-Efficiency of 98.06.

Following the removal of the implausible combinations, the level balance across the two questionnaires was:

Attribute / Level	A1	A2	A3	A4	A5	A6
L1	16	24	48	23	24	24
L2	16	23	48	25	24	24
L3	17	25		25	24	24
L4	16	24		23	24	24
L5	15					
L6	16					
Total	96	96	96	96	96	96

Table 6.5 - Level Balance within Questionnaire Design after the Removal of Implausible Combinations

The orthogonality of the design was also checked post adjustment for implausible combinations. This is defined by Ryan and colleagues as "occurrence of one attribute does not depend on any other attribute" (Ryan et al., 2014:105). Using the 'CORREL' function in Excel for Mac 2016 the results are shown in table 6.6. This demonstrated that the values were close to zero (no correlation at all) in all cases meaning that the pollution of the main effects of one attribute by another was minimal.

	A1	A2	A3	A4	A5	A6
A1	1					
A2	0.162	1				
A3	0.091	0.075	1			
A4	0.125	0.025	0.007	1		
A5	-0.082	-0.113	0	-0.017	1	
A6	-0.033	-0.096	0	0.136	-0.100	1

Table 6.6 - Correlation between Attributes

6.2.2.3 Overlap

Overlap occurs when within a choice set an attribute has the same level for both choices (Johnson et al 2013). The original design generated by JMP Pro did not include any overlap within choice sets. However, the adjustments to eliminate implausible combinations meant that the final design has overlap in the choice sets for the 'time to result' attribute.

In order to minimise the effect of the overlap, the four combinations to remove implausible combinations (by switching the time to result) were tested to see whether:

- any duplicate choice sets were created
- any duplicate choices were created
- how many choice sets contained overlap.

The final combination selected for the management of implausible combinations was the one which created no duplicate choices and provided an equal balance of the number of choice sets containing overlap between the two questionnaires. The loss of statistical efficiency has been accepted in the interests of securing response efficiency; that is, presenting respondents with plausible choices for completion in the questionnaire. No precise measure of acceptability in terms of loss of statistical efficiency has been identified, Johnson and colleagues state that "designs that are nearly balanced and nearly orthogonal usually are still well identified. As long as the collinearity is not severe, all the parameters of interest will be sufficiently identified and estimation is feasible" (Johnson et al., 2013:8).

6.2.3 Preference Elicitation

Bridges and colleagues note that it is imperative to ensure that participants have an appropriate level of information to complete the tasks including background information and an explanation of attributes and levels (Bridges et al., 2011). Background information and an explanation of attributes and levels were developed and shared initially with a small group of researchers in the eSTI^2 research consortium, including two sexual health consultants to check factual accuracy and obtain general feedback on comprehension prior to cognitive testing.

The background information and sample choice sets were subject to three rounds of cognitive testing to test comprehension within the target age range. The results are reported in section 6.3.1.

6.2.3.1 Instrument Design

Bridges and colleagues note "it is important to elicit respondent-specific health and socio-demographic information to allow for testing for systematic differences in preference based on these characteristics" (Bridges et al 2011:409).

In determining the range of socio-demographic characteristics to be collected, consideration was firstly given to which sub-groups to analyse. These were in part limited by funding (as the overall sample size increases). Two sub-groups were selected to form the basis of the quota sampling:

- Age-bands within the 16-24 age range - there is evidence to suggest from the focus groups undertaken to inform the DCE design and the uptake of the online consultation within the exploratory study that there may be a difference between the younger and older age groups within the 16-24 age range.
- Gender – there is evidence in the uptake data for the NCSP which shows a difference in the number of male and female young people having a chlamydia test (PHE, 2016b).

In addition to age and gender it was also decided to collect demographic information on the following characteristics:

- Ethnicity (defined by the ONS dataset),
- Region of Residence (defined by the Government Office regions),
- Sexual Preference (Heterosexual, Homosexual (Gay/ Lesbian) or Bisexual),

- Relationship Status (Single, in a relationship with one person, in a sexual relationship with one person, in a relationship with more than one person, in a sexual relationship with more than one person),
- Whether previously tested for an STI (yes/ no).

The development of the background information and description of attributes and levels was subject to cognitive testing to minimise the risk of misinterpretation. Further information on the results of this is included within section 6.3.

Finally, for consideration in the questionnaire design was the level of burden imposed upon respondents. Bridges and colleagues note that there are a number of factors that can affect this, including: survey length, difficulty and incentive (Bridges et al 2011). The review of published DCE studies by Clark and colleagues identified that between 2009-12 the majority of studies (62%) had between eight and 16 choices and the percentage with over 16 choices had remained stable at 15% when compared with the previous review period ((2001-2008) at 18% (De Bekker-Grob et al., 2010, Clark et al., 2014). As outlined in section 6.2.2, cognitive testing was undertaken on a questionnaire with 24 choice sets to see whether participants found it too lengthy or burdensome to complete. This found that 24 choice sets was acceptable to participants.

The incentive was determined by YouthSight, the company operating the research panel who have a prescribed structure for reimbursement of participation as outlined in section 3.7. Participants were therefore familiar with the level of reward offered for a survey of this length.

6.2.4 Data Collection

Bridges and colleagues suggest that sample size calculations for DCEs are complex and do not identify a specific method by which they should be calculated (Bridges et al., 2011). Orme recommends that where sub-group analysis is undertaken there should be a minimum of 200 respondents in each sub-group (Orme, 2010). Therefore, to reach a minimum of 200 respondents for each of the six gender and age-specific sub-groups a total sample size of 1,200 is required, 600 per questionnaire. The sample size breakdown per questionnaire is provided in the table 6.7:

	Age 16-18	Age 19-21	Age 22-24	Total per Questionnaire
Male	100	100	100	300
Female	100	100	100	300
Total per Questionnaire	200	200	200	600

Table 6.7 - DCE Sampling Strategy per Questionnaire

An online research panel was selected as the route to recruit participants to fulfil the requirements of the sampling strategy in a timely manner recognising the large sample size, and the need to gain access to the general population as opposed to recruitment via healthcare settings. Funding was secured from the eSTI[2] research programme to do this. Ethical considerations for the survey are outlined in section 3.7.

6.2.5 Statistical Analyses

Three types of statistical analysis were undertaken:

i. Descriptive statistics for the participants, drawn from the demographic data,
ii. Assessment of the internal validity of the data,
iii. Analysis and interpretation of the DCE responses.

Demographic characteristics of respondents are presented in section 6.5.1.

Assessment of the external validity of DCE data is recognised as problematic (Lancsar & Louviere, 2008, Clark et al., 2014) with the true test of external validity being whether stated preference data reflect 'real' behaviour (revealed preference data) (Ryan et al., 2008). In studies such as this where new technology is being explored, with a number of hypothetical levels, revealed preference data are generally not available. A number of methods have therefore been identified for assessing the internal validity of the data including:

- Repeated questions (Bridges et al., 2011),
- A dominant choice within a choice set (where all levels in one choice are better than the other (Bridges et al., 2011),
- Identification of participants who "nearly always choose the alternative with the best level of one attribute" (Bridges et al., 2011:410),
- "Checking if signs of estimated parameters are consistent with a priori expectations" (Lancsar and Louviere, 2008:672),
- Internal consistency/ rationality (Ryan et al., 2008).

In their review of recently published DCE studies in healthcare, Clark and colleagues identified that the most commonly reported tests for validity are theoretical validity tests, including whether parameters are consistent with a priori expectations (Clark et al., 2014).

To assess the internal validity of the questionnaire an analysis of the number of responses for each option was undertaken. In addition, the following methods were selected and tested by comparing the full dataset with the dataset with the following responses removed:

- Repeated choice set – respondents provide the same answer to the repeated choice set,
- Time to complete questionnaire – data where responses took less than the minimum time during the cognitive testing,
- Opt out question data – where the 'I would not test' option was selected.

Tests for internal consistency and rationality were not included because there is a suggestion that to exclude responses on this basis may be an inappropriate imposition of rationality (Clark et al., 2014). The results of the internal validity checks are presented in section 6.5.2.

In selecting the model for the analysis of the data it was identified that convention for choice sets including three or more alternatives is to use the multinomial logit (MNL) model developed by McFadden (also known as the conditional logit model) (Ryan et al., 2008, Ryan et al., 2014). Louviere and colleagues identify the MNL model as the core choice model used for the analysis of stated preference data in a variety of fields including transport, marketing and environmental (Louviere et al., 2003). In addition, Clark and colleagues point to an increase in the use of this modelling approach in reported DCE studies in healthcare from 22% of studies published between 2001 and 2008 and 44% of studies published between 2009 and 2012 (Clark et al., 2014).

The MNL estimator has a number of assumptions, summarised by Ryan and colleagues as:

- "Error terms independent across observations
- Independence of irrelevant alternatives (IIA)
- Homogeneity of preferences" (Ryan et al., 2014:220).

The IIA condition is recognised as a strength and weakness within the MNL approach. Louviere and colleagues state that "its strength is that it provides a computationally convenient choice model, and permits introduction and/ or elimination of alternatives in choice sets without re-estimation. Its weakness is that the observed and unobserved attributes of utility may not be independent of one another, and/ or if the unobserved components of utility are correlated among alternatives, this leads to biased utility parameters and added errors in forecasts." (Louviere et al., 2003:45).

STATA13 SE was used to conduct the analysis of the DCE responses using the 'clogit' command, utilising the method and code outlined by the University of Aberdeen course 'Using Discrete Choice Experiments in Health Economics: Theoretical and Practical Issues' (Ryan et al., 2014.).

Variables within the model were all treated as categorical variables for the analysis. Attribute levels were specified using dummy variables as it was identified that dummy coding is the most recognised approach within healthcare research (Bridges et al., 2011), and is the preferred form of coding where odds ratios are to be calculated (Ijzerman et al., 2016). Dummy coding requires that one level be 'dropped' for each attribute and this level "can be chosen arbitrarily" (Ryan et al., 2014:196).

Within the model the levels that were dropped reflect a sexual health clinic pathway; this was chosen as it represents one option currently available to young people to access chlamydia testing. The other NCSP Chlamydia testing options can be comprised of a number of different combinations of levels and would therefore not offer the clarity of a single pathway. The 'dropped' levels which form the reference level for each attribute are summarised in table 6.8:

Attribute	Reference Level (Dropped Level)
How you Test	Sexual Health Clinic
Time to Result	7 Days
Accuracy	5 in 100 (False Negative)
Consultation Method	Sexual Health Clinic
Access to HCP	Face to Face
How you get Antibiotics	Collect from Clinic

Table 6.8 - Dummy Coding Reference Level

6.3 Methods – Pilot Phase

The purpose of the pilot phase was to test the draft questionnaire and associated background information. These were piloted on respondents within the sample age range using cognitive interviewing methodology - drawing on both the 'think aloud' and probing paradigms (Beatty and Willis, 2007, Campanelli, 1997). The cognitive interviews involved a one-to-one interview using both concurrent and retrospective probing, with probes scripted in advance (ibid.). Concurrent probing was used for the first half of the questionnaire, with questions following each of the sections (background, definitions and demographic), to test participants' understanding of key terms used within these sections.

Retrospective probing was used for the choice part of the questionnaire. Participants completed the 25 choice sets in their entirety with the participant being made aware, prior to completion, that they would be asked how they made their choice for each choice set at the end. Finally, a series of debriefing questions were asked to determine the participants' level of confidence in their answers and how difficult they found the questionnaire to complete. The interview schedule for the third round of interviews is included in Appendix 13.

The pilot study was undertaken in phases. After undertaking the initial phase, the results were reviewed to identify the revisions, and then the next iteration of the questionnaire was piloted. A final sample size was not determined in advance as it was an iterative process, continuing until no new significant issues impacting on completion of the questionnaire were being identified (Willis, 1999). Convenience sampling was used for expediency within the target age range (16-24) for the questionnaire. Participants were recruited via the University of Warwick's research recruitment system. A hard copy of the questionnaire was used, presenting the text that would be uploaded into the online survey.

After each phase the responses were summarised with a specific focus on:

- Terms used where the participant did not interpret their meaning as intended.
- Responses to choice questions to determine whether any specific attribute dominated, that is, whether the participant selected choices based on one specific attribute over the others consistently.

6.3.1 Pilot Phase Results

In total nine cognitive interviews were undertaken in three rounds. The demographic characteristics of participants are summarised in table 6.9:

	n	%
Age		
19	2	22%
20	3	33%
21	1	11%
24	3	33%
Gender		
Male	1	11%
Female	8	89%
Ethnic Origin		
White British	3	33%
White Other	1	11%
Chinese	3	33%
Bangladeshi	1	11%
Black African	1	11%
Highest Qualification		
A-Level	5	56%
Degree	2	22%
Post-Grad	2	22%

Table 6.9 - Demographic Characteristics of Cognitive Testing Participants

Although not formally captured as part of the demographic information, it was observed during the interviews that six of the nine participants' first language was not English. There were three participants in the first round of cognitive testing, two in the second round and four in the third round. The interview lengths ranged from 36 to 57 minutes.

The cognitive interviews found broadly that participants understood the introduction, key terms and definitions used. However, it was identified by participants in round one and round two that clarification was needed on terms relating to Epididymitis and azithromycin. As a suggestion from a participant in round two a visual representation of the pathway was incorporated to aid in understanding. Incorporation of additional questions into the third round of interviews identified that participants were able to articulate what the diagrams meant. It was therefore decided to retain them in the final questionnaire.

In respect of the choice sets, the first round of cognitive testing revealed that the difference in the accuracy levels (2 in 100 versus 8 in 100) dominated as the reason for selecting a choice for two of the three participants; therefore, in the second round, the level was reduced to 5 in 100. The reasons for selecting choice sets in rounds two and three revealed a range of factors for making the choice from respondents. Therefore, it was decided to proceed with the revised level in the final DCE. Implausible combinations were left in the choice sets in the first round of the cognitive testing. The third participant identified the conflict between posting a sample for analysis and getting the result in two hours as being impossible and therefore they did not make that choice. As a result, it was decided to remove implausible combinations from the choice sets. Implausible combinations were removed for rounds two and three of the cognitive testing.

In terms of completion of the questionnaire, all participants indicated that they felt sure of their answers, however, three of the nine participants indicated that they went back and changed one or two answers as they progressed through the questionnaire. Participants indicated that they did not find it difficult to complete the choice questions, with three participants indicating that they found they needed to think about some choices longer than others. One of the nine participants indicated that completion became monotonous because of the number of choices.

In completing the questionnaire, the time to complete the 25 choice sets ranged from four minutes 46 seconds to nine minutes 56 seconds. Eight of the nine participants answered the duplicate set correctly. Reviewing the total number of participants selecting A, B or choosing not to test showed that there was variance across the questions. In no choice set did all participants choose option A, option B or not to test.

A summary of the changes made to the questionnaire is provided in table 6.10.

Changes following Round 1	Changes following Round 2	Changes following Round 3
• Minor changes to words to explain Epididymitis • Clarification that time to result does not affect accuracy • Adjustment of accuracy level from 8 to 5 • Clarification of the relationship question in demographic section • Restatement of instructions on completion immediately prior to the choice sets • Removal of implausible combinations	• Minor clarification points on azithromycin • Incorporation of flow diagrams and associated explanatory text • Clarification of results notification process	• Re-ordering of points to correspond with ordering of levels in questionnaire • Minor amendments to demographic questions following feedback from ethics committee

Table 6.10 - Questionnaire Changes Following Each Round of Cognitive Testing

6.4 DCE Data Collection & Management

The questionnaire was scripted by YouthSight and test links were provided for review. A copy extracts from the questionnaire's introduction and a sample of the choice sets are included in Appendix 14. YouthSight used their standard approach to promoting the questionnaire to potential participants via email and managed the participation to ensure that the sampling quotas were met. Data collection was paused after 50 responses on each questionnaire to test the model. Data collection with the online panel took place between 12 November and 26 November 2015.

Data were provided by YouthSight in two Excel files – one containing labelled data and one containing coded data. Data were prepared for analysis in Excel for Mac 2016 and STATA13 SE in accordance with the method outlined by Ryan and colleagues (Ryan et al., 2014). Choice set 1 was repeated in the questionnaire as choice set 25 for validity checks. Therefore, it was necessary to drop the responses to one choice set from the analysis. Choice set 1 was dropped as at the start of the questionnaire participants are generally less familiar with the adopted survey approach. This is discussed further in section 6.5.2.

6.5 DCE Results

6.5.1 Respondent Characteristics

In total, 1,230 responses to the questionnaire were received, a further 490 people commenced the questionnaire but did not complete it giving a completion rate of 73%. No further information was available about the demographic characteristics of those who did not complete the questionnaire. The breakdown of the demographic characteristics of respondents is summarised in table 6.11; where national comparative data can be identified this has been included.

Demographic Characteristic	n	%	National %[4]
Age			
16	8	1%	10%
17	113	9%	10%
18	294	24%	11%
19	183	15%	11%
20	132	11%	11%
21	91	7%	11%
22	162	13%	11%
23	135	11%	12%
24	112	9%	12%
Total	1230	100%	99%
Gender			
Male	607	49%	51%
Female	623	51%	49%
Total	1230	100%	100%
Ethnicity			
White – English, Welsh, Scottish, Northern Irish, British	932	76%	80%
White – Irish	7	1%	1%
White – Gypsy or Irish Traveller	1	0%	0%
White – Any other white background	37	3%	5%
Mixed/ Multiple Ethnic Groups – White & Black Caribbean	10	1%	1%
Mixed/ Multiple Ethnic Groups –	6	0%	0%

[4] - National Data for Age and Region taken from ONS Mid-Year Population Estimates 2015 (ONS, 2016b). Percentages derived from the total 16-24 population. National Data for Ethnicity taken from Census 2011 data, percentages derived from total England population (ONS, 2012). Percentages may not sum due to rounding

Demographic Characteristic	n	%	National %[4]
White & Black African			
Mixed/ Multiple Ethnic Groups – White & Asian	13	1%	1%
Mixed/ Multiple Ethnic Groups – Any other mixed/ multiple ethnic background	8	1%	1%
Asian/ Asian British – Indian	50	4%	3%
Asian/ Asian British - Pakistani	38	3%	2%
Asian/ Asian British - Bangladeshi	18	1%	1%
Asian/ Asian British - Chinese	22	2%	1%
Asian/ Asian British – Any other Asian background	21	2%	2%
Black/ African/ Caribbean/ Black British – African	26	2%	2%
Black/ African/ Caribbean/ Black British – Caribbean	10	1%	1%
Black/ African/ Caribbean/ Black British – Any other black/ African/ Caribbean background	2	0%	1%
Other – Arab	5	0%	0%
Other – Any other ethnic group	9	1%	1%
I would prefer not to say	15	1%	0%
Total	1230	100%	103%
Region			
East Midlands	117	10%	9%
London	225	18%	15%
North East	74	6%	5%
North West	123	10%	13%
Eastern	55	4%	10%
South East	222	18%	16%
South West	143	12%	10%
West Midlands	144	12%	11%
Yorkshire and The Humber	113	9%	11%
I would prefer not to say	14	1%	0%
Total	1230	100%	100%
Sexual Preference			
Heterosexual (partner of opposite sex)	1030	84%	
Homosexual (partner of same sex) & Male	13	1%	
Homosexual (partner of same sex) & Female	39	3%	
Bisexual (partner of either sex)	98	8%	
I would prefer not to say	50	4%	
Total	1230	100%	
Previous STI Test			
Yes	393	32%	
No	790	64%	

Demographic Characteristic	n	%	National %[4]
I would prefer not to say	47	4%	
Total	1230	100%	
Relationship Status			
Single	615	50%	
In a non-sexual relationship with one person	36	3%	
In a non-sexual relationship with more than one person	2	0%	
In a sexual relationship with one person	512	42%	
In a sexual relationship with more than one person	36	3%	
I would prefer not to say	29	2%	
Total	1230	100%	

Table 6.11 - Demographic Characteristics of DCE Respondents

Comparing the DCE sample characteristics to the national population (England) characteristics shows that the gender and ethnicity makeup of participants is broadly in line with national population demographics. For age, it can be seen that at the proportions within the age bands are not as reflective of the national population, specifically the 16-18 range age. As illustrated in table 6.12 the age ranges are broadly reflective of the percentage of the 16-24 year olds falling into each age band. However, it can be seen from table 6.11 that there is a disproportionately higher number of 18 year olds and disproportionately lower number of 16 year olds completing the survey.

In terms of the geographic region of participants, the sample is broadly in line with the geographic distribution of 16-24 year olds identified in the ONS Mid-Year Population Estimates 2015 (Office for National Statistics, 2016c), with the exception of a smaller proportion completing the survey from the East of England.

Two demographic characteristics were identified a priori in the sampling frame for sub-group analysis – gender and age range. The total number of respondents in each sub-category for analysis are summarised in table 6.12:

Demographic Characteristic	n	%	National %
Age Range			
16-18	415	34%	31%
19-21	406	33%	33%
22-24	409	33%	35%
Gender			
Male	607	49%	51%
Female	623	51%	49%

Table 6.12 - Demographic Characteristics of Sub-Groups for Analysis

In addition, a review of the demographic data identified sufficient responses on each questionnaire to undertake sub-group analysis – relationship status (single and in a sexual relationship with one person), and whether previously tested for an STI (yes or no). It was therefore decided to include these additional sub-groups in the analysis.

6.5.2 Quality of Responses

As identified in section 6.2.5 a number of validity checks were adopted in this study:

- Repeated choice set
- Time to complete questionnaire
- Removal of the opt out question data
- Analysis of number of responses for each option.

The results of these validity checks are summarised and discussed in turn.

6.5.2.1 Repeated Choice Set

In each of the two questionnaires choice set 1 was repeated as the 25th choice set with option A and option B reversed. Analysis of the number of respondents who provided the same answer to both choice sets is included in table 6.13:

	n	%
Same answer for choice sets 1 and 25	912	74%
Different answer for choice sets 1 and 25	318	26%

Table 6.13 - Analysis of Repeated Question Responses, Full Dataset

Reviewing this for the two questionnaires individually shows a slightly higher percentage of respondents on the first questionnaire answered both questions correctly than the second questionnaire. A chi^2 test demonstrated that this is not a statistically significant difference (Chi^2 = 1.221, p-value=0.269):

	n	%
Questionnaire 1		
Same answer for choice sets 1 and 25	463	76%
Different answer for choice sets 1 and 25	150	24%
Questionnaire 2		
Same answer for choice sets 1 and 25	449	73%
Different answer for choice sets 1 and 25	168	27%

Table 6.14 - Analysis of Repeated Question Responses at Individual Questionnaire Level

The published reviews of DCE studies did not include information on the proportion of repeated choice sets answered correctly within published studies. A further literature search to identify any publications containing information on this failed to identify any published reviews considering this. One paper within the review of stated preference studies included in section 4.2 (Phillips et al., 2002) reported that 25% of respondents did not answer the repeated choice set correctly and noted that "these levels are similar to those found in other studies which range from 9 percent to 39 percent" (Phillips et al., 2002:1693). Therefore, the incorrect response rate to the repeated choice set in this survey appears to be in line with other published studies.

In respect of whether to include the response to the first or last question in the dataset, a clear view has not been identified from the literature. There are two arguments to be considered:

- Inclusion of the responses to the first choice set – as people complete the questionnaire they become fatigued and therefore their response to the first question is more reliable than the last question,
- Inclusion of the responses to the last choice set – at the start of the questionnaire people are unsure of the DCE tasks and as they progress they become more familiar with the choice process and therefore their response to the last question is more reliable than their response to the first question.

Table 6.15 compares the results from the model run on the full dataset comparing the inclusion of responses to Q1 and Q25 in each questionnaire. Levels highlighted in blue indicate a p-value of greater than 0.05 (demonstrated by the CI for the coefficient including 0 and the CI for the OR including 1). This can be interpreted as the strength of preference for these levels not being statistically significant compared to the reference level.

There is one difference in respect of statistical significance of levels – 'post to collection point' is not statistically significant when using data from choice set 25 (OR of 1.031 with a 95% CI of 0.981 to 1.085) but is statistically significant when using data from choice set 1 (OR of 1.053 with a 95% CI of 1.002 to 1.106). The order of strength of preference within the attributes remains the same for how you test, time to result, accuracy, access to a healthcare professional and how you get your antibiotics. However, there is a difference in order of preference for treatment consultation method.

Using data from choice set one the order of strength of preference is online consultation (OR 1.203), pharmacy consultation (OR 1.162) and GP consultation (OR 1.157), compared with choice set 25 where the order is online consultation (OR 1.212), GP consultation (OR 1.183) and pharmacy consultation (OR 1.158).

Given the relative closeness of the odds ratio and confidence intervals across the datasets which option should be selected was considered. Clark and colleagues noted that 60% of published studies between 2009 and 2012 contained an internal validity check and this was "an assessment of whether coefficients appear to move in line with a priori expectations" (Clark et al., 2014:11). Their literature review did not consider the use of repeated questions as an internal validity measure. A search of the literature did not identify any other reviews of stated preference studies that considered the utilisation of data from repeated choice sets as a validity measure.

In the absence of a clearly established method for the selection of which question response to choose in respect of a repeated question the latter option was selected, subscribing to the theory that as people complete the questionnaire they become more familiar with the choice process. Consequently, choice set 25 data was included in the dataset used for analysis.

	Dataset Including Choice Set 1, *n=1,230*						Dataset Including Choice Set 25, *n=1,230*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test												
Self-Test	0.498	0.432	0.564	1.646	1.540	1.758	0.481	0.415	0.547	1.618	1.514	1.729
Post	0.308	0.239	0.376	1.360	1.270	1.456	0.306	0.239	0.373	1.358	1.271	1.452
Pharmacy	0.116	0.056	0.175	1.123	1.057	1.192	0.144	0.085	0.203	1.155	1.088	1.226
Education/ Work	-0.206	-0.266	-0.146	0.814	0.766	0.864	-0.197	-0.257	-0.137	0.821	0.773	0.872
GP Practice	0.011	-0.050	0.073	1.011	0.951	1.075	0.019	-0.042	0.081	1.019	0.959	1.084
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result												
30 Mins	0.579	0.524	0.633	1.784	1.688	1.884	0.591	0.537	0.645	1.806	1.711	1.906
2 Hours	0.340	0.283	0.398	1.406	1.328	1.488	0.338	0.281	0.395	1.402	1.324	1.485
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.149	-0.200	-0.099	0.861	0.819	0.906	-0.148	-0.198	-0.098	0.862	0.820	0.907
Accuracy												
2 in 100 False Negative	1.192	1.157	1.226	3.292	3.179	3.409	1.176	1.141	1.212	3.242	3.130	3.359
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method												
Online Consultation	0.185	0.133	0.236	1.203	1.142	1.266	0.192	0.140	0.245	1.212	1.150	1.277
Pharmacy Consultation	0.150	0.099	0.202	1.162	1.104	1.224	0.147	0.095	0.199	1.158	1.100	1.220

	Dataset Including Choice Set 1, *n=1,230*						Dataset Including Choice Set 25, *n=1,230*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
GP Consultation	0.146	0.095	0.197	1.157	1.100	1.218	0.168	0.116	0.220	1.183	1.123	1.246
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional												
Phone	-0.058	-0.108	-0.008	0.943	0.897	0.992	-0.052	-0.102	-0.002	0.949	0.903	0.998
Instant Messenger	0.020	-0.029	0.070	1.020	0.971	1.072	0.027	-0.023	0.076	1.027	0.977	1.079
Email	0.027	-0.023	0.076	1.027	0.978	1.079	0.047	-0.002	0.096	1.048	0.998	1.101
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
How you get Antibiotics												
Post to Home	0.038	-0.013	0.089	1.039	0.987	1.093	0.011	-0.041	0.063	1.011	0.960	1.065
Post to Collection Point	0.052	0.002	0.101	1.053	1.002	1.106	0.030	-0.020	0.081	1.031	0.980	1.085
Collect from Pharmacy	0.091	0.038	0.143	1.095	1.039	1.154	0.072	0.018	0.126	1.075	1.018	1.134
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Choice												
Option A	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Option B	-0.341	-0.381	-0.302	0.711	0.683	0.740	-0.360	-0.400	-0.320	0.698	0.670	0.726
I would not test	-1.697	-1.797	-1.596	0.183	0.166	0.203	-1.682	-1.781	-1.583	0.186	0.168	0.205

Table 6.15 - Comparison of Full Dataset Coefficients and ORs for Dataset including Choice Set 1 and Dataset including Choice Set 25

	Full Dataset *n=1,230*						Excl Incorrect Answer to Validity Check *n=912*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test												
Self-Test	0.481	0.415	0.547	1.618	1.514	1.729	0.507	0.429	0.584	1.660	1.535	1.794
Post	0.306	0.239	0.373	1.358	1.271	1.452	0.333	0.254	0.411	1.395	1.290	1.508
Pharmacy	0.144	0.085	0.203	1.155	1.088	1.226	0.124	0.054	0.194	1.132	1.056	1.214
Education/ Work	-0.197	-0.257	-0.137	0.821	0.773	0.872	-0.253	-0.323	-0.183	0.777	0.724	0.833
GP Practice	0.019	-0.042	0.081	1.019	0.959	1.084	0.019	-0.053	0.091	1.019	0.948	1.095
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result												
30 Mins	0.591	0.537	0.645	1.806	1.711	1.906	0.573	0.510	0.637	1.774	1.665	1.890
2 Hours	0.338	0.281	0.395	1.402	1.324	1.485	0.335	0.268	0.402	1.397	1.307	1.494
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.148	-0.198	-0.098	0.862	0.820	0.907	-0.148	-0.177	-0.236	-0.117	0.790	0.889
Accuracy												
2 in 100 False Negative	1.176	1.141	1.212	3.242	3.130	3.359	1.323	1.282	1.364	3.755	3.602	3.913
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method												
Online Consultation	0.192	0.140	0.245	1.212	1.150	1.277	0.197	0.136	0.258	1.218	1.145	1.294

	Full Dataset *n=1,230*						Excl Incorrect Answer to Validity Check *n=912*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
Pharmacy Consultation	0.147	0.095	0.199	1.158	1.100	1.220	0.173	0.112	0.234	1.189	1.119	1.264
GP Consultation	0.168	0.116	0.220	1.183	1.123	1.246	0.179	0.119	0.240	1.196	1.126	1.271
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional												
Phone	-0.052	-0.102	-0.002	0.949	0.903	0.998	-0.084	-0.143	-0.026	0.919	0.867	0.975
Instant Messenger	0.027	-0.023	0.076	1.027	0.977	1.079	-0.026	-0.084	0.031	0.974	0.919	1.032
Email	0.047	-0.002	0.096	1.048	0.998	1.101	-0.005	-0.063	0.052	0.995	0.939	1.054
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
How you get Antibiotics												
Post to Home	0.011	-0.041	0.063	1.011	0.960	1.065	0.014	-0.047	0.075	1.014	0.954	1.078
Post to Collection Point	0.030	-0.020	0.081	1.031	0.980	1.085	0.023	-0.036	0.083	1.024	0.964	1.086
Collect from Pharmacy	0.072	0.018	0.126	1.075	1.018	1.134	0.065	0.001	0.128	1.067	1.001	1.137
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Choice												
Option A	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Option B	-0.360	-0.400	-0.320	0.698	0.670	0.726	-0.327	-0.374	-0.279	0.721	0.688	0.756
I would not test	-1.682	-1.781	-1.583	0.186	0.168	0.205	-1.674	-1.790	-1.557	0.188	0.167	0.211

Table 6.16 - Coefficients and Odds Ratios for the Full Dataset and the Dataset Excluding Different Responses to Choice Sets 1 and 25

Table 6.16 shows that comparing the results from the model run on the full dataset and the exclusion of the responses with different answers for choice sets 1 and 25 shows that whilst there is some difference in the coefficients and odds ratios for each level, the results follow the same pattern.

6.5.2.2 *Time to Complete Questionnaire*

Using an online research panel allowed for the time to complete the questionnaire to be captured for each participant. A summary of the time taken to complete the questionnaire is provided in table 6.17 and illustrated in the histogram (figure 6.1):

	Minutes: Seconds
Mean	08:42
Minimum	01:19
25th Percentile	05:34
Median	07:51
75th Percentile	11:07
Maximum	30:19

Table 6.17 - Time Taken to Complete Questionnaire

The cognitive testing identified a range to complete the questionnaire of 04:46 to 09:56 minutes with a mean time to completion of 07:15 minutes. Recognising that the time to completion was a timing of the completion of the choice sets only, a threshold of five minutes or greater was applied to the responses in the dataset; this is the minimum time to completion observed in the cognitive testing rounded up to the nearest full minute. The number of responses were then analysed and grouped by less than five minutes and five minutes or more, and whether the repeated question was answered correctly. This identified that 76% participants who took five minutes or longer to complete the survey gave the same answer to the repeated question compared with 67% of those taking less than five minutes to complete the survey (see table 6.18).

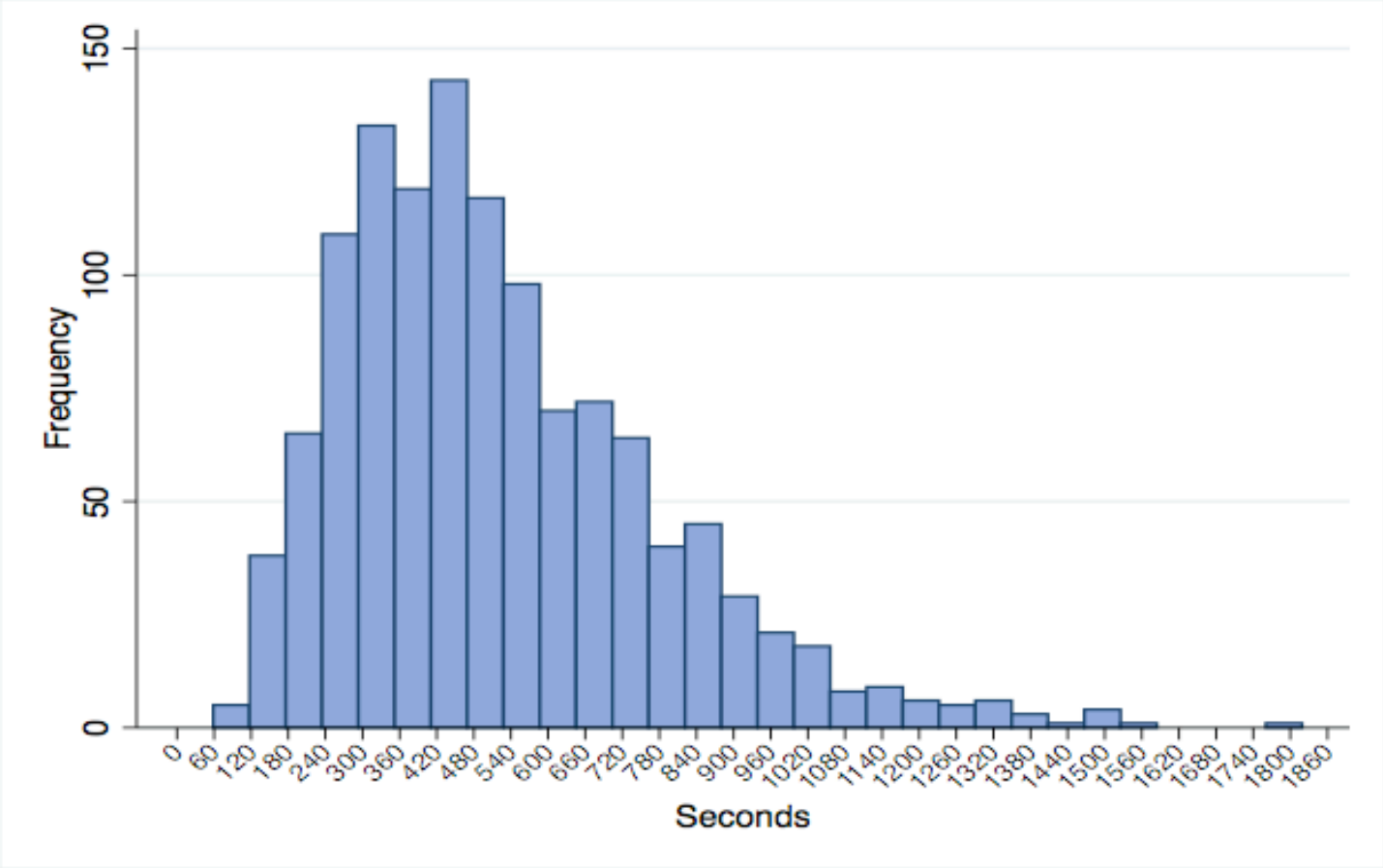

Figure 6.1- Histogram of time taken to complete the questionnaire

	n	%
Responses completed in less than 5 minutes	233	19%
Responses completed in 5 minutes or more	997	81%
Responses completed in less than 5 minutes where repeated question was answered correctly	155	67%
Responses completed in less than 5 minutes where repeated question was answered incorrectly	78	33%
Responses completed in 5 minutes or more where repeated question was answered correctly	757	76%
Responses completed in 5 minutes or more where repeated question was answered correctly	240	24%

Table 6.18 - Analysis of Survey Completion Time and Repeated Question Responses

Running the model on the full dataset and the dataset excluding responses which took less than five minutes to complete again showed that whilst there were some differences in the coefficients and odds ratios for each level, the results followed the same pattern. It was concluded that there was no requirement to exclude the responses taking less than five minutes to complete.

	Full Dataset *n=1,230*						Data Excluding Responses taking less than 5 min to complete *n= 997*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test												
Self-Test	0.481	0.415	0.547	1.618	1.514	1.729	0.542	0.467	0.616	1.719	1.595	1.852
Post	0.306	0.239	0.373	1.358	1.271	1.452	0.344	0.269	0.419	1.411	1.309	1.521
Pharmacy	0.144	0.085	0.203	1.155	1.088	1.226	0.168	0.101	0.234	1.183	1.106	1.264
Education/ Work	-0.197	-0.257	-0.137	0.821	0.773	0.872	-0.245	-0.312	-0.177	0.783	0.732	0.837
GP Practice	0.019	-0.042	0.081	1.019	0.959	1.084	-0.008	-0.077	0.061	0.992	0.925	1.062
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result												
30 Mins	0.591	0.537	0.645	1.806	1.711	1.906	0.642	0.581	0.703	1.900	1.788	2.019
2 Hours	0.338	0.281	0.395	1.402	1.324	1.485	0.372	0.308	0.436	1.451	1.361	1.547
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.148	-0.198	-0.098	0.862	0.820	0.907	-0.147	-0.204	-0.091	0.863	0.816	0.913
Accuracy												
2 in 100 False Negative	1.176	1.141	1.212	3.242	3.130	3.359	1.308	1.269	1.348	3.700	3.556	3.850
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method												
Online Consultation	0.192	0.140	0.245	1.212	1.150	1.277	0.217	0.159	0.276	1.243	1.172	1.318
Pharmacy Consultation	0.147	0.095	0.199	1.158	1.100	1.220	0.160	0.102	0.219	1.174	1.108	1.245
GP Consultation	0.168	0.116	0.220	1.183	1.123	1.246	0.171	0.113	0.229	1.187	1.120	1.258
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional												
Phone	-0.052	-0.102	-0.002	0.949	0.903	0.998	-0.042	-0.098	0.014	0.959	0.906	1.014
Instant Messenger	0.027	-0.023	0.076	1.027	0.977	1.079	0.043	-0.013	0.098	1.044	0.987	1.103
Email	0.047	-0.002	0.096	1.048	0.998	1.101	0.042	-0.013	0.097	1.043	0.987	1.102
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

	Full Dataset *n=1,230*						Data Excluding Responses taking less than 5 min to complete *n= 997*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you get Antibiotics												
Post to Home	0.011	-0.041	0.063	1.011	0.960	1.065	0.001	-0.057	0.060	1.001	0.944	1.062
Post to Collection Point	0.030	-0.020	0.081	1.031	0.980	1.085	0.013	-0.044	0.070	1.013	0.957	1.072
Collect from Pharmacy	0.072	0.018	0.126	1.075	1.018	1.134	0.085	0.024	0.145	1.089	1.025	1.157
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Choice												
Option A	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Option B	-0.360	-0.400	-0.320	0.698	0.670	0.726	-0.368	-0.413	-0.323	0.692	0.662	0.724
I would not test	-1.682	-1.781	-1.583	0.186	0.168	0.205	-1.776	-1.889	-1.662	0.169	0.151	0.190

Table 6.19 - Coefficients and Odds Ratios for the Full Dataset and the Dataset Containing Responses taking 5 Minutes or Longer to Complete

6.5.2.3 *Analysis of the number of responses for each option*

Another validity consideration is the number of times 'Option A', 'Option B' or 'I would not test' were selected. This is summarised in table 6.20 below:

Choice	n	%
A	16,176	54.8
B	11,551	39.13
Opt Out	1,793	6.07
Total	29,520	100

Table 6.20 - Analysis of Choice Selection

To understand this further, analysis was undertaken on the distribution of the levels between option A and option B to ascertain whether using attributes with known logical choices (e.g. shorter time to result, higher accuracy) it would have been expected that more participants would have chosen option A or option B. The detail of this analysis is shown in table 6.21:

	Option A	Option B
How you Test		
Self-Test	10	6
Post	11	5
Pharm	7	10
Education/ Work	7	9
GP Practice	7	8
Sexual Health Clinic	6	10
Total	48	48
Time to Result		
30 Mins	16	8
2 Hours	8	15
7 Days	13	12
14 Days	11	13
Total	48	48
Accuracy (False Negative)		
2 in 100 False Negative	28	20
5 in 100 False Negative	20	28
Total	48	48
Consultation Method		

	Option A	Option B
Online Consultation	10	13
Pharmacy Consultation	13	12
GP Consultation	10	15
Sexual Health Clinic Consultation	15	8
Total	48	48
Access to Healthcare Professional		
Phone	10	14
Instant Messenger	12	12
Email	14	10
Face to Face	12	12
Total	48	48
How you get Antibiotics		
Post to Home	13	11
Post to Collection Point	13	11
Collect from Pharmacy	16	8
Collect from Sexual Health Clinic	6	18
Total	48	48

Table 6.21 - Level Distribution between Option A and Option B[5]

The results showed that for the attributes with a logical preference (shorter time to result and higher accuracy, highlighted in green) the shortest waiting time and highest accuracy featured in option A more frequently than in option B. Therefore it is to be expected that more people would select option A than option B

The other levels with the strongest level of preference (highlighted in orange in table 6.21) showed that three out of four of these had the greater number of levels featured in option A. Consequently, it was concluded that a higher proportion of respondents would select option A than option B and no responses should be removed from the dataset as a result of this.

5 - Please note that the rows in the table 6.21 do not all sum to 16, they reflect the level balance achieved from the design created by SAS JMP Pro 9.2.0, adjusted for implausible combinations. For further information see section 6.2.2.2 and table 6.5.

6.5.2.4 Removal of the opt out question data

The final piece of analysis undertaken to explore the validity of the data was to remove the 'opt out' data before drawing comparison to the full dataset. The results of this analysis are summarised in table 6.22.

	Full Dataset *n=29,520 Choice Responses*						Removal of 'I would not test' Data *n=27,727 Choice Responses*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test												
Self-Test	0.481	0.415	0.547	1.618	1.514	1.729	0.501	0.433	0.568	1.650	1.542	1.765
Post	0.306	0.239	0.373	1.358	1.271	1.452	0.320	0.252	0.387	1.377	1.287	1.473
Pharmacy	0.144	0.085	0.203	1.155	1.088	1.226	0.152	0.092	0.212	1.164	1.096	1.236
Education/ Work	-0.197	-0.257	-0.137	0.821	0.773	0.872	-0.202	-0.262	-0.141	0.817	0.769	0.868
GP Practice	0.019	-0.042	0.081	1.019	0.959	1.084	0.027	-0.035	0.089	1.027	0.965	1.093
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result												
30 Mins	0.591	0.537	0.645	1.806	1.711	1.906	0.612	0.558	0.667	1.845	1.746	1.949
2 Hours	0.338	0.281	0.395	1.402	1.324	1.485	0.350	0.292	0.408	1.419	1.339	1.503
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.148	-0.198	-0.098	0.862	0.820	0.907	-0.145	-0.196	-0.094	0.865	0.822	0.910
Accuracy												
2 in 100 False Negative	1.176	1.141	1.212	3.242	3.130	3.359	1.205	1.170	1.241	3.338	3.221	3.460
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method												
Online Consultation	0.192	0.140	0.245	1.212	1.150	1.277	0.200	0.147	0.253	1.222	1.159	1.288
Pharmacy Consultation	0.147	0.095	0.199	1.158	1.100	1.220	0.159	0.106	0.211	1.172	1.112	1.235
GP Consultation	0.168	0.116	0.220	1.183	1.123	1.246	0.174	0.122	0.227	1.190	1.130	1.254
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional												
Phone	-0.052	-0.102	-0.002	0.949	0.903	0.998	-0.046	-0.097	0.004	0.955	0.908	1.004
Instant Messenger	0.027	-0.023	0.076	1.027	0.977	1.079	0.029	-0.021	0.079	1.029	0.979	1.082
Email	0.047	-0.002	0.096	1.048	0.998	1.101	0.050	0.000	0.100	1.051	1.000	1.105
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

	Full Dataset *n=29,520 Choice Responses*						Removal of 'I would not test' Data *n=27,727 Choice Responses*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you get Antibiotics												
Post to Home	0.011	-0.041	0.063	1.011	0.960	1.065	0.012	-0.041	0.065	1.012	0.960	1.067
Post to Collection Point	0.030	-0.020	0.081	1.031	0.980	1.085	0.035	-0.016	0.086	1.036	0.984	1.090
Collect from Pharmacy	0.072	0.018	0.126	1.075	1.018	1.134	0.076	0.021	0.131	1.079	1.022	1.139
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Choice												
Option A	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Option B	-0.360	-0.400	-0.320	0.698	0.670	0.726	-0.368	-0.409	-0.327	0.692	0.664	0.721
I would not test	-1.682	-1.781	-1.583	0.186	0.168	0.205	-	-	-	1.000		

Table 6.22 - Comparison of Full Dataset and Dataset Excluding Opt Out Responses

Again, this showed that the full dataset and the dataset excluding the opt out data behave in broadly the same way, with the same general trends in terms of strength of preference.

To summarise, the four options considered to test the internal validity of the data presented in the previous sections showed that in comparison to the full dataset all yielded very similar coefficients and odds ratios with no change in the order of the strength of preference for a level within each attribute. On this basis it was determined that the full dataset should be used for the detailed analysis of the DCE responses.

6.5.2.5 Respondent Participation and Feedback

In total 1,230 completed responses were achieved by YouthSight from their panel of approximately 108,500 young people within the target age range (YouthSight, 2014). Their analytics data showed that an additional 460 people started but did not complete the survey. No further information is available on the demographics of these participants nor any information on the point at which they chose to exit the survey.

At the end of the questionnaire participants were asked to score how they rated the survey and were provided with an opportunity to provide qualitative feedback through a 'free text box'. The breakdown of the questionnaire ratings is provided in table 6.23:

	n	%
Very Good	163	13%
Good	473	38%
Average	393	32%
Poor	118	10%
Very Poor	32	3%
Prefer Not to Say	51	4%
	1,230	100%

Table 6.23 - Summary of Questionnaire Rating by Participants

The breakdown of qualitative feedback by response category is provided in table 6.24:

Questionnaire Rating Category	Number of Participants Commenting	% Commenting	% of Overall Comments
Very Good	19	12%	9%
Good	47	10%	22%
Average	75	19%	36%
Poor	53	45%	25%
Very Poor	16	50%	8%
Prefer Not to Say	1	2%	0%
Total	211	17%	100%

Table 6.24 - Breakdown of Qualitative Feedback by Response Category

This indicates that the majority of participants (83%) found the questionnaire average/ satisfactory to complete. This is reassuring within the context of the sample population, i.e. a population who have signed up to a panel to complete online surveys. The qualitative feedback was explored through a simple thematic analysis to draw out the learning points. Looking at the frequency of comments, repetition was the issue cited most frequently with 79 of the 211 commenting indicated that they found the questionnaire repetitive; this varied in degrees from “very repetitive” to “thorough but quite repetitive”. Nineteen of the 211 commenting indicated that they felt the questionnaire was ‘too long’, with one offering a degree of relativity “far too wordy and long-winded for a £1 survey”.

6.5.3 Summary of the DCE Responses

Tables 6.27-6.32 present the results from the DCE for the full dataset and the subgroups analysed as both coefficients and odds ratios (OR), along with the 95% confidence intervals (CI). The odds ratios are used throughout this section when discussing the findings, however the coefficients will be used in section 6.6 for exploring the findings within the context of pathways and probabilities of uptake. Levels highlighted in blue indicate a p-value of greater than 0.05 (demonstrated by the CI for the coefficient including 0 and the CI for the OR including 1). This can be interpreted as the strength of preference for these levels not being statistically significant compared to the reference level.

Looking across all attributes and levels participants expressed the strongest preference for accuracy of the test result (OR 3.242). Accuracy was expressed as the likelihood of a false negative result. This point links to the findings of the focus groups that demonstrated a lack of understanding that tests are not '100% accurate'. Considering accuracy across the subgroups analysed, there are notable differences in the strength of preference between males and females (OR 2.950 and 3.570 respectively), and those who have previously tested and not tested (OR 2.999 and 3.482 respectively). Possible reasons for this include the consequences for males personally are not as severe as they are for women as evidenced in the background literature for participants, or that they would manage the consequences of a false result differently. For example, it was the male focus group participants who suggested their alternatives including taking multiple tests and attending clinic if they are unsure. Those who have tested for STIs previously may be more familiar with the fact that a test does not deliver a '100% accurate' result.

Time to result was the attribute with the next strongest preference across all sub-groups, with results consistent with the logical expectation that people would prefer a shorter waiting time than a longer one. Comparing ORs between sub-groups showed no substantial differences, with the exception of age where the 19-21 year olds showed a stronger preference for 30 minutes and 2 hours (OR 1.888 and 1.548 respectively) compared with the 7 day reference level. Whereas the strength of preference was lower for 16-18 year olds (OR 1.763 and 1.326) and 22-24 year olds (OR 1.772 and 1.344).

Considering how to test, all subgroups demonstrated the strongest preference for self-testing (OR 1.618) and testing via an outreach services in an educational/ work setting was the least preferred option (OR 0.821). Postal testing was the second strongest preference across all sub-groups (OR 1.358). For testing via a sexual health clinic (reference level) and testing via a GP practice there was no statistically significant difference between the two options with the exception of the previous testing history sub-groups, with an OR of 0.885 for those who have previously tested and those who have not (OR 1.101). Taking a sample to a pharmacy for analysis was preferable to attending a sexual health clinic for all subgroups with the exception of those who had previously tested and 19-21 year olds where there was no statistically significant difference.

This was a consistent strength of preference for the options which do not have any direct contact with healthcare professionals (self-testing and postal testing) compared with those that do (taking a sample to a pharmacy, an outreach clinic at place of education/ work, attending a GP practice or sexual health clinic) across all subgroups. However, there were notable variations in the strength of preference for 'how you test' between sub-groups:

- Females had a stronger preference for the more remote testing options (self-test, OR 1.693, postal test, OR 1.411) than males (OR 1.549 and 1.308 respectively).
- The older age range (22-24) had a stronger preference for self-testing (OR 1.895) compared with the younger age groups, (16-18 OR 1.664, 19-21 OR 1.346).
- For those in a relationship with one sexual partner there was a stronger preference for self-testing (OR 1.711) compared with those who were single (OR 1.632). However, those who were single had a stronger preference for taking a sample to a pharmacy (OR 1.220) than those in a relationship with one partner (OR 1.109).
- The largest difference in the strength of preferences was in the subgroup who had previously tested for an STI compared with those that had not. Those that had not previously tested for an STI had a greater preference for remote testing options (self-test OR 1.678, postal test OR 1.465) than those that had previously tested (OR 1.524 and OR 1.178 respectively), and also had a stronger preference for taking a sample to a pharmacy for analysis (OR 1.277) than those who had previously tested (OR 0.945 not statistically significant).

Again, the preference for a remote (from a sexual health clinic) pathway can be seen in the preference for consultation method following a positive test result via an online consultation (OR 1.212), followed by treatment via general practice (OR 1.183) and treatment via pharmacy (OR 1.158) in the full dataset. However, at the subgroup level there was more variation in the order of preference for this attribute than any other in the survey, with the exception of the sexual health clinic which was consistently the least preferred across all subgroups. This is illustrated in table 6.25.

Consultation Method Order of Preferences	Subgroup
First	
Online Consultation	Male Female Age 22-24 Relationship with one sexual partner Previously tested for an STI Not Previously tested for an STI
Pharmacy	Age 19-21
GP	Age 16-18 Single
Second	
Online Consultation	Age 16-18 Age 19-21 Single
Pharmacy	Female Relationship with one sexual partner
GP	Male Age 22-24 Previously tested for an STI Not previously tested for an STI
Third	
Online	-
Pharmacy	Male Age 16-18 Age 22-24 Single Previously tested for an STI
GP	Female Age 19-21 In a sexual relationship with one partner

Table 6.25 - Order of Preferences by Subgroup - Consultation Method Attribute

The differences in the strength of preference suggest that some subgroups have a preference for a consultation method which involves contact with a healthcare professional rather than an online pathway where contact is only made if there is a problem. This in part reflects the focus group findings where the focus groups with the younger age range placed greater importance on being able to talk to a healthcare professional.

Whilst there is a statistically significant preference for all consultation methods when compared with a sexual health clinic, the full dataset showed that for method of access to a healthcare professional there was no statistically significant preference for instant messenger or email access compared to accessing a healthcare professional face-to-face. Telephone access to a healthcare professional was the least preferred option (OR 0.949), which is a statistically significant result, indicating a preference for face-to-face access compared with phone access. Examining this attribute at subgroup level shows no statistically significant preference for method of access over another with the exception of instant messaging within the 16-18 age group (OR 1.108), and phone (OR 0.902) within the 19-21 age group.

The final attribute 'how you get your antibiotics' showed a statistically significant preference for collection from a pharmacy within the full dataset compared with collection from a sexual health clinic (OR 1.075). There was a preference for posting to home or a collection point (OR 1.011 and OR 1.031 respectively), however this was not statistically significant when compared with collection from a sexual health clinic. At a subgroup level, there were very few statistically significant preferences being limited to collection from a pharmacy for females (OR 1.087), 19-21 year olds (OR 1.106) and people who have not previously tested for an STI (OR 1.078), a statistically significant preference for posting to a collection point for males (OR 1.082).

	Full Dataset *n=1,230*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test						
Self-Test	0.481	0.415	0.547	1.618	1.514	1.729
Post	0.306	0.239	0.373	1.358	1.271	1.452
Pharmacy	0.144	0.085	0.203	1.155	1.088	1.226
Education/ Work	-0.197	-0.257	-0.137	0.821	0.773	0.872
GP Practice	0.019	-0.042	0.081	1.019	0.959	1.084
Sexual Health Clinic	0.000	-	-	1.000	-	-
Time to Result						
30 Mins	0.591	0.537	0.645	1.806	1.711	1.906
2 Hours	0.338	0.281	0.395	1.402	1.324	1.485
7 Days	0.000	-	-	1.000	-	-
14 Days	-0.148	-0.198	-0.098	0.862	0.820	0.907
Accuracy						
2 in 100 False Negative	1.176	1.141	1.212	3.242	3.130	3.359
5 in 100 False Negative	0.000	-	-	1.000	-	-
Consultation Method						
Online Consultation	0.192	0.140	0.245	1.212	1.150	1.277
Pharmacy Consultation	0.147	0.095	0.199	1.158	1.100	1.220
GP Consultation	0.168	0.116	0.220	1.183	1.123	1.246
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-
Access to Healthcare Professional						
Phone	-0.052	-0.102	-0.002	0.949	0.903	0.998
Instant Messenger	0.027	-0.023	0.076	1.027	0.977	1.079
Email	0.047	-0.002	0.096	1.048	0.998	1.101
Face to Face	0.000	-	-	1.000	-	-

	Full Dataset *n=1,230*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you get Antibiotics						
Post to Home	0.011	-0.041	0.063	1.011	0.960	1.065
Post to Collection Point	0.030	-0.020	0.081	1.031	0.980	1.085
Collect from Pharmacy	0.072	0.018	0.126	1.075	1.018	1.134
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-

Table 6.26 - Full Dataset Coefficients, Odds Ratios and Respective 95% Confidence Intervals

	Males *n=607*						Females *n=623*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test												
Self-Test	0.438	0.344	0.531	1.549	1.410	1.701	0.526	0.432	0.620	1.693	1.541	1.860
Post	0.269	0.174	0.363	1.308	1.190	1.438	0.344	0.250	0.439	1.411	1.284	1.551
Pharmacy	0.123	0.039	0.208	1.131	1.040	1.231	0.165	0.081	0.249	1.180	1.085	1.283
Education/ Work	-0.084	-0.169	0.001	0.919	0.845	1.001	-0.310	-0.395	-0.225	0.733	0.674	0.798
GP Practice	0.048	-0.039	0.135	1.049	0.962	1.145	-0.010	-0.097	0.077	0.990	0.908	1.080
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result												
30 Mins	0.603	0.527	0.680	1.828	1.694	1.973	0.580	0.503	0.656	1.786	1.654	1.928
2 Hours	0.311	0.230	0.392	1.365	1.259	1.479	0.366	0.285	0.447	1.442	1.329	1.563
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.170	-0.241	-0.098	0.844	0.786	0.906	-0.127	-0.198	-0.056	0.881	0.820	0.945
Accuracy												
2 in 100 False Negative	1.082	1.032	1.132	2.951	2.807	3.101	1.273	1.223	1.322	3.570	3.396	3.753
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method												
Online Consultation	0.171	0.097	0.245	1.187	1.102	1.278	0.214	0.140	0.288	1.239	1.151	1.334
Pharmacy Consultation	0.100	0.027	0.173	1.106	1.028	1.189	0.194	0.121	0.268	1.215	1.129	1.307
GP Consultation	0.159	0.085	0.232	1.172	1.089	1.262	0.178	0.104	0.251	1.194	1.110	1.285
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional												
Phone	-0.065	-0.136	0.005	0.937	0.873	1.005	-0.039	-0.110	0.032	0.962	0.896	1.032
Instant Messenger	-0.006	-0.076	0.063	0.994	0.927	1.065	0.060	-0.010	0.130	1.062	0.990	1.139
Email	0.033	-0.036	0.103	1.034	0.965	1.108	0.060	-0.009	0.130	1.062	0.991	1.139
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
How you get Antibiotics												
Post to Home	-0.004	-0.078	0.070	0.996	0.925	1.072	0.027	-0.046	0.101	1.028	0.955	1.106
Post to Collection Point	0.079	0.007	0.151	1.082	1.007	1.163	-0.017	-0.089	0.055	0.983	0.915	1.056
Collect from Pharmacy	0.062	-0.014	0.138	1.064	0.986	1.149	0.083	0.007	0.160	1.087	1.007	1.173
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

Table 6.27 - Gender Subgroup Analysis Coefficients and Odds Ratios with Associated 95% Confidence Interval

	16-18 *n=415*						19-21 *n=406*						22-24 *n=409*					
	Coeffi-cient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coeffi-cient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coeffi-cient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test																		
Self-Test	0.509	0.395	0.623	1.664	1.485	1.865	0.297	0.182	0.412	1.346	1.200	1.510	0.639	0.523	0.755	1.895	1.687	2.128
Post	0.390	0.275	0.505	1.477	1.316	1.657	0.129	0.013	0.245	1.138	1.013	1.277	0.397	0.281	0.513	1.487	1.324	1.670
Pharmacy	0.239	0.137	0.342	1.270	1.147	1.408	0.021	-0.082	0.124	1.021	0.921	1.132	0.170	0.067	0.273	1.185	1.069	1.314
Education/ Work	-0.218	-0.322	-0.114	0.804	0.725	0.892	-0.215	-0.319	-0.112	0.806	0.727	0.894	-0.160	-0.265	-0.056	0.852	0.768	0.945
GP Practice	0.081	-0.025	0.187	1.085	0.975	1.206	0.035	-0.072	0.141	1.035	0.931	1.152	-0.061	-0.168	0.046	0.941	0.846	1.047
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result																		
30 Mins	0.567	0.474	0.661	1.763	1.606	1.936	0.636	0.542	0.730	1.888	1.719	2.074	0.572	0.478	0.666	1.772	1.613	1.947
2 Hours	0.282	0.183	0.381	1.326	1.201	1.464	0.437	0.338	0.536	1.548	1.402	1.709	0.295	0.196	0.395	1.344	1.216	1.484
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.130	-0.217	-0.044	0.878	0.805	0.957	-0.125	-0.213	-0.038	0.882	0.808	0.963	-0.189	-0.277	-0.102	0.828	0.758	0.903
Accuracy																		
2 in 100 False Negative	1.196	1.135	1.257	3.307	3.112	3.514	1.151	1.090	1.212	3.161	2.974	3.361	1.188	1.127	1.250	3.282	3.086	3.489
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method																		
Online Consultation	0.171	0.081	0.262	1.187	1.085	1.299	0.182	0.092	0.273	1.200	1.096	1.314	0.226	0.135	0.317	1.253	1.144	1.373
Pharmacy Consultation	0.154	0.065	0.244	1.167	1.067	1.276	0.190	0.100	0.279	1.209	1.105	1.322	0.098	0.007	0.188	1.102	1.007	1.206

	16-18 *n=415*						19-21 *n=406*						22-24 *n=409*					
	Coeffi-cient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coeffi-cient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coeffi-cient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
GP Consultation	0.246	0.157	0.335	1.279	1.170	1.398	0.133	0.043	0.223	1.142	1.044	1.250	0.125	0.035	0.215	1.133	1.036	1.240
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional																		
Phone	0.001	-0.085	0.087	1.001	0.918	1.091	-0.104	-0.190	-0.017	0.902	0.827	0.983	-0.055	-0.142	0.031	0.946	0.868	1.032
Instant Messenger	0.102	0.017	0.188	1.108	1.017	1.207	-0.024	-0.109	0.062	0.977	0.897	1.064	0.001	-0.085	0.087	1.001	0.918	1.091
Email	0.075	-0.009	0.160	1.078	0.991	1.174	0.037	-0.048	0.122	1.038	0.954	1.130	0.029	-0.056	0.115	1.030	0.945	1.122
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
How you get Antibiotics																		
Post to Home	-0.024	-0.114	0.066	0.977	0.893	1.068	0.010	-0.081	0.100	1.010	0.922	1.106	0.047	-0.043	0.137	1.048	0.957	1.147
Post to Collection Point	0.010	-0.078	0.097	1.010	0.925	1.102	0.035	-0.053	0.123	1.036	0.948	1.131	0.046	-0.042	0.135	1.047	0.959	1.144
Collect from Pharmacy	0.039	-0.054	0.132	1.039	0.947	1.141	0.101	0.008	0.195	1.106	1.008	1.215	0.077	-0.017	0.171	1.080	0.983	1.186
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

Table 6.28 - Age Range Subgroup Analysis Coefficients and Odds Ratios, including Respective 95% Confidence Intervals

	Single *n=615*						Sexual Relationship with One Partner *n=512*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test												
Self-Test	0.490	0.396	0.584	1.632	1.486	1.792	0.538	0.434	0.641	1.712	1.543	1.899
Post	0.322	0.227	0.416	1.380	1.255	1.516	0.322	0.218	0.425	1.380	1.244	1.530
Pharmacy	0.199	0.115	0.283	1.220	1.122	1.327	0.104	0.011	0.196	1.109	1.011	1.217
Education/ Work	-0.162	-0.247	-0.077	0.851	0.781	0.926	-0.251	-0.344	-0.157	0.778	0.709	0.854
GP Practice	-0.006	-0.093	0.081	0.994	0.911	1.085	0.063	-0.032	0.159	1.066	0.969	1.172
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result												
30 Mins	0.548	0.471	0.625	1.730	1.602	1.867	0.640	0.556	0.724	1.896	1.743	2.062
2 Hours	0.271	0.190	0.352	1.311	1.209	1.422	0.416	0.327	0.505	1.516	1.387	1.657
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.148	-0.220	-0.077	0.862	0.803	0.926	-0.149	-0.227	-0.071	0.862	0.797	0.932
Accuracy												
2 in 100 False Negative	1.186	1.137	1.236	3.275	3.116	3.443	1.196	1.141	1.250	3.305	3.129	3.492
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method												
Online Consultation	0.145	0.071	0.219	1.156	1.074	1.245	0.251	0.169	0.332	1.285	1.185	1.394
Pharmacy Consultation	0.108	0.035	0.182	1.115	1.036	1.199	0.203	0.123	0.284	1.225	1.130	1.328
GP Consultation	0.150	0.077	0.223	1.162	1.080	1.250	0.173	0.092	0.253	1.189	1.097	1.288
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional												
Phone	-0.059	-0.130	0.011	0.942	0.878	1.011	-0.077	-0.155	0.000	0.926	0.856	1.000
Instant Messenger	0.025	-0.045	0.095	1.025	0.956	1.099	-0.009	-0.086	0.068	0.991	0.918	1.071
Email	0.066	-0.003	0.136	1.069	0.997	1.145	0.001	-0.076	0.077	1.001	0.927	1.080
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

	Single *n=615*						Sexual Relationship with One Partner *n=512*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you get Antibiotics												
Post to Home	-0.044	-0.118	0.030	0.957	0.889	1.030	0.053	-0.028	0.134	1.055	0.973	1.144
Post to Collection Point	-0.032	-0.104	0.040	0.968	0.901	1.041	0.070	-0.009	0.149	1.072	0.991	1.160
Collect from Pharmacy	0.067	-0.009	0.143	1.070	0.991	1.154	0.055	-0.029	0.139	1.056	0.971	1.149
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

Table 6.29 - Relationship Status Subgroup Analysis Coefficients and Odds Ratios, including Respective 95% Confidence Intervals

	Previous Test n=393						No Previous Test *n=790*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you Test												
Self-Test	0.422	0.305	0.539	1.524	1.356	1.714	0.518	0.434	0.601	1.678	1.544	1.824
Post	0.164	0.047	0.280	1.178	1.048	1.323	0.382	0.298	0.466	1.465	1.347	1.594
Pharmacy	-0.056	-0.160	0.048	0.945	0.852	1.049	0.245	0.170	0.320	1.277	1.185	1.377
Education/ Work	-0.273	-0.377	-0.168	0.761	0.686	0.845	-0.150	-0.225	-0.074	0.861	0.798	0.928
GP Practice	-0.122	-0.229	-0.014	0.885	0.795	0.986	0.097	0.019	0.174	1.101	1.019	1.190
Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Time to Result												
30 Mins	0.592	0.498	0.687	1.808	1.645	1.988	0.586	0.518	0.654	1.797	1.679	1.923
2 Hours	0.305	0.205	0.406	1.357	1.227	1.500	0.353	0.281	0.425	1.423	1.325	1.529
7 Days	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
14 Days	-0.125	-0.213	-0.037	0.882	0.808	0.963	-0.156	-0.219	-0.093	0.856	0.803	0.912
Accuracy												
2 in 100 False Negative	1.099	1.037	1.160	3.000	2.820	3.191	1.248	1.203	1.292	3.482	3.331	3.640
5 in 100 False Negative	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Consultation Method												
Online Consultation	0.161	0.069	0.252	1.174	1.071	1.287	0.205	0.140	0.271	1.228	1.150	1.311
Pharmacy Consultation	0.094	0.003	0.184	1.098	1.003	1.203	0.168	0.103	0.233	1.183	1.108	1.262
GP Consultation	0.106	0.015	0.197	1.112	1.015	1.217	0.195	0.130	0.260	1.215	1.139	1.297
Sexual Health Clinic Consultation	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-
Access to Healthcare Professional												
Phone	-0.054	-0.142	0.034	0.947	0.868	1.034	-0.048	-0.110	0.015	0.953	0.895	1.015
Instant Messenger	0.044	-0.042	0.131	1.045	0.958	1.140	0.025	-0.037	0.087	1.025	0.963	1.091
Email	0.048	-0.038	0.134	1.049	0.962	1.144	0.053	-0.009	0.114	1.054	0.991	1.121
Face to Face	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

	Previous Test n=393						No Previous Test *n=790*					
	Coefficient	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**	**Odds Ratio**	**Lower 95% CI**	**Upper 95% CI**
How you get Antibiotics												
Post to Home	0.011	-0.081	0.102	1.011	0.922	1.107	0.020	-0.046	0.085	1.020	0.955	1.089
Post to Collection Point	0.034	-0.056	0.123	1.034	0.946	1.131	0.034	-0.029	0.098	1.035	0.971	1.103
Collect from Pharmacy	0.083	-0.012	0.177	1.086	0.988	1.194	0.075	0.008	0.143	1.078	1.008	1.153
Collect from Sexual Health Clinic	0.000	-	-	1.000	-	-	0.000	-	-	1.000	-	-

Table 6.30 - Previous STI Testing Subgroup Analysis Coefficients and Odds Ratios, including Respective 95% Confidence Intervals

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
n	**1,230**	**607**	**623**	**415**	**406**	**409**	**615**	**512**	**393**	**790**
	Odds Ratio	**Odds Ratio**	**Odds Ratio**	**Odds Ratio**	**Odds Ratio**	**Odds Ratio**	**Odds Ratio**	**Odds Ratio**	**Odds Ratio**	**Odds Ratio**
How you Test										
Self-Test	1.618	1.549	1.693	1.664	1.346	1.895	1.632	1.712	1.524	1.678
Post	1.358	1.308	1.411	1.477	1.138	1.487	1.380	1.380	1.178	1.465
Pharmacy	1.155	1.131	1.180	1.270	1.021	1.185	1.220	1.109	0.945	1.277
Education/ Work	0.821	0.919	0.733	0.804	0.806	0.852	0.851	0.778	0.761	0.861
GP Practice	1.019	1.049	0.990	1.085	1.035	0.941	0.994	1.066	0.885	1.101
Sexual Health Clinic	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Time to Result										
30 Mins	1.806	1.828	1.786	1.763	1.888	1.772	1.730	1.896	1.808	1.797
2 Hours	1.402	1.365	1.442	1.326	1.548	1.344	1.311	1.516	1.357	1.423
7 Days	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
14 Days	0.862	0.844	0.881	0.878	0.882	0.828	0.862	0.862	0.882	0.856
Accuracy										
2 in 100 False Negative	3.242	2.951	3.570	3.307	3.161	3.282	3.275	3.305	3.000	3.482
5 in 100 False Negative	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Consultation Method										
Online Consultation	1.212	1.187	1.239	1.187	1.200	1.253	1.156	1.285	1.174	1.228
Pharmacy Consultation	1.158	1.106	1.215	1.167	1.209	1.102	1.115	1.225	1.098	1.183
GP Consultation	1.183	1.172	1.194	1.279	1.142	1.133	1.162	1.189	1.112	1.215
Sexual Health Clinic Consultation	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Access to Healthcare Professional										
Phone	0.949	0.937	0.962	1.001	0.902	0.946	0.942	0.926	0.947	0.953
Instant Messenger	1.027	0.994	1.062	1.108	0.977	1.001	1.025	0.991	1.045	1.025
Email	1.048	1.034	1.062	1.078	1.038	1.030	1.069	1.001	1.049	1.054
Face to Face	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
How you get Antibiotics										
Post to Home	1.011	0.996	1.028	0.977	1.010	1.048	0.957	1.055	1.011	1.020
Post to Collection Point	1.031	1.082	0.983	1.010	1.036	1.047	0.968	1.072	1.034	1.035
Collect from Pharmacy	1.075	1.064	1.087	1.039	1.106	1.080	1.070	1.056	1.086	1.078
Collect from Sexual Health Clinic	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 6.31 - Odds Ratios for all Sub-Groups Included within the Analysis

6.6 Applying Stated Preference Data to Pathway Design

The results from the DCE can be used to estimate the probability of uptake of an option and can be particularly helpful when exploring the potential uptake of new services (Ryan et al. 2014). The probability that an individual takes up a given option (P_1) is the exponential of the utility divided by the sum of all of the alternatives, this is represented in the following equation:

$$P_1 = \frac{e^{V_1}}{\sum_j^J = 1\ e^j}$$

Where *j* is the alternative and *J* is any other alternative within the choice set (Ryan et al., 2014).

Utilising the coefficients from the DCE results in table 6.27, the probability of uptake has first been considered for the three pathways within the eSTI[2] exploratory study: the sexual health clinic (the reference pathway within the DCE), the NCSP internet testing pathway, and fully remote online pathway, and the 'I would not test' option. Recognising that test accuracy has been identified as the attribute for which respondents expressed the strongest preference, accuracy has been assumed to be the same for the fully remote online pathway as for the GUM and NCSP internet testing pathway for this initial analysis. Table 6.33 summarises the make-up of the pathway attributes and levels and table 6.34 contains the sum of the coefficients for each of the pathway options and for each of the sub-groups within the DCE analysis. Table 6.35 shows the ORs for each pathway for each subgroup and table 6.36 summarises the probability of pathway uptake.

	How you Test	Time to Result	Test Accuracy (False Negative)	Consultation Method	Access to HCP	How you get your Antibiotics
Sexual Health Clinic Pathway	Attend sexual health clinic, sample taken by HCP	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Sexual health clinic	Face to face	Collect from sexual health clinic
NCSP Internet Testing Pathway	Order test kit online, self-sample and post off for analysis	14 Days	5 in 100 people will be told they don't have chlamydia when they do	Pharmacy	Face to face	Collect from pharmacy
Fully Remote Online Pathway	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Phone	Collect from pharmacy

Table 6.32 - Composition of Pathways

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Sexual Health Clinic Pathway	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NCSP Postal Testing Pathway	0.377	0.262	0.495	0.453	0.294	0.382	0.349	0.431	0.214	0.469
Fully Remote Online Pathway	1.284	1.209	1.365	1.288	1.113	1.459	1.191	1.406	1.203	1.336
I would not test	-1.682	-1.584	-1.796	-1.322	-1.901	-1.877	-1.601	-2.013	-2.283	-1.458

Table 6.33 - Pathway Coefficients

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**
Sexual Health Clinic Pathway	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
NCSP Postal Testing Pathway	1.458	1.299	1.641	1.572	1.342	1.465	1.418	1.539	1.239	1.599
Fully Remote Online Pathway (Pharmacy Collect)	3.612	3.350	3.914	3.624	3.043	4.301	3.290	4.078	3.331	3.806
I would not Test	0.186	0.205	0.166	0.267	0.149	0.153	0.202	0.134	0.102	0.233

Table 6.34 - Pathway Odds Ratios

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Sexual health clinic	16%	17%	15%	15%	18%	14%	17%	15%	18%	15%
NCSP Postal Testing	23%	22%	24%	24%	24%	21%	24%	23%	22%	24%
Fully Remote Online Pathway (Pharm Collect)	58%	57%	58%	56%	55%	62%	56%	60%	59%	57%
I would not test	3%	4%	2%	4%	3%	2%	3%	2%	2%	4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.35 - Probability of Pathway Uptake

This analysis predicts that should the fully remote online pathway be introduced, a higher proportion of people choosing to test across all subgroups would choose this pathway to test and get treatment. The pathway with the second highest uptake would be the NCSP internet testing pathway, followed closely by the sexual health clinic. Of the three testing options available a low percentage (2-4% across all subgroups) would not choose any of the three pathways.

In considering the 'I would not test' option it is important that this is not misinterpreted when applying it to uptake. In framing the DCE questionnaire, the introduction to the survey stated:
"In completing the survey you will be presented with a number of choices for getting tested and treatment for chlamydia. Please consider each set of choices and indicate whether you prefer option A or option B or whether you would not test, that is, you would not choose option A or option B."

The decision not to test is taken within the context of the two individual testing choices presented to the individual, having just been presented with a summary of why it is important to test for chlamydia and the consequences of not testing. This cannot be interpreted in the same way as an individual deciding whether to test for chlamydia or not, therefore, when applying the probabilities of uptake to a general population it is important not to interpret this as 97% of the population would take up testing.

Having considered the implementation of a fully remote online pathway alongside two existing pathways, the data can also be used to optimise the fully remote online pathway, assess the likely impact of integrating new technology and remote options into existing pathways, and explore the impact of variables in the test design.

6.6.1 Optimising the Fully Remote Online Pathway

Although it is predicted that the envisaged fully remote online pathway would have a greater uptake than the existing sexual health clinic or NCSP internet testing pathways, the coefficients presented in tables 6.28 to 6.32 demonstrate that the combination of levels are not the optimum for maximising uptake of the fully remote online pathway.

Varying the combination of levels to create a pathway incorporating the levels with the strongest preference in the main dataset for each attribute leads to two changes being made to levels – to increase the accuracy of the test result to 'two in 100 results are false negatives', and changing access to a healthcare professional to 'email access', as illustrated in table 6.36. Creating a scenario where the concept and optimum pathways were presented as a choice, the probability of uptake of the optimum pathway is 77% compared with 22% for the concept pathway (for the full dataset). A summary of the probability of uptake is shown in table 6.37 for all subgroups. Although there is a small variance in the percentage for each line, the results are consistent across all subgroups.

	How you Test	Time to Result	Test Accuracy (False Negative)	Consultation Method	Access to HCP	How you get your Antibiotics
Concept Fully Remote Online Pathway	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Phone	Collect from pharmacy
Optimum Fully Remote Online Pathway (2 in 100 false negative)	Self-Test	30 Mins	2 in 100 people will be told they don't have chlamydia when they do	Online consultation	Email	Collect from pharmacy

Table 6.36 - Optimising the Fully Remote Online Pathway

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways										
Concept Fully Remote Online Pathway	22%	23%	20%	22%	21%	22%	21%	22%	23%	20%
Optimum Fully Remote Online Pathway	77%	75%	79%	77%	78%	78%	78%	78%	76%	78%
Not Test	1%	1%	1%	2%	1%	1%	1%	1%	1%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.37 - Probability of Pathway Uptake (Optimised Fully Remote Online Pathway)

In optimising the pathway, test accuracy, as the attribute with the greatest strength of preference, has a significant impact on uptake. Taking this out of the equation, and focusing specifically on the element of the pathway relating to treatment, there are two attributes which warrant further exploration. These are 'access to a healthcare professional' and 'how you get your antibiotics' because the results indicated no statistically significant difference in preference between the levels in the majority of subgroups. This is worthy of further consideration because it suggests that it would have a minimal influence over people's decision to choose an option. From a health service delivery perspective this may be an important consideration from the perspective of cost-efficiency, as options such as postal delivery may provide a cheaper pathway solution than a face-to-face alternative.

Table 6.38 summarises the fully remote online pathway options with 'how you get your antibiotics' varied for each of the possible levels, and table 6.39 outlines the probability of uptake if each of the four options were available. This demonstrates very little difference in uptake between the four pathways (24-26%) with 'collect from pharmacy' being the option with the highest/ joint highest probability of uptake in all subgroups, except males, where a slightly higher preference for delivery to collection point is expressed. Delivery to collection point was also as likely to be chosen as collection from pharmacy in the 16-18 age range and people in a sexual relationship with one partner. Whilst there are examples of delivery of drugs for chlamydia within private sexual healthcare there are no examples within mainstream sexual health services, therefore identifying an area of further research in the development of remote sexual health pathways.

	How you Test	Time to Result	Test Accuracy (False Negative)	Consultation Method	Access to HCP	How you get your Antibiotics
Concept Fully Remote Online Pathway (collect from pharmacy)	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Phone	Collect from pharmacy
Fully Remote Online Pathway with home delivery	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Phone	Deliver to home address
Fully Remote Online Pathway with delivery to a collection point	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Phone	Deliver to collection point
Fully Remote Online Pathway with collection from a sexual health clinic	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Phone	Collect from sexual health clinic

Table 6.38 - Pathways exploring remote options for how you get your antibiotics

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways										
Collect from pharmacy	26%	25%	26%	25%	26%	26%	26%	25%	26%	26%
Deliver to home	24%	24%	25%	24%	24%	25%	24%	25%	24%	24%
Deliver to collection point	25%	26%	24%	25%	25%	25%	24%	25%	25%	25%
Collect from sexual health clinic	24%	24%	24%	24%	24%	24%	25%	24%	24%	24%
Not Test	1%	2%	1%	2%	1%	1%	2%	1%	1%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.39 - Probability of Pathway Uptake (How you get your antibiotics options)

Exploring access to a healthcare professional within the context a fully remote online pathway is also an important consideration when optimising the pathway to maximise likely uptake. The full dataset shows a statistically significant preference for not using the phone to access a healthcare professional with a weaker preference for this than the comparator (face-to-face). The strongest preference within this attribute (although not statistically significant) is email.

Table 6.40 summarises the pathway make up, and table 6.41 shows the probability of uptake should each of the four pathways be available. Again, there is very little difference in likely uptake between the four pathways when the 'access to healthcare professional' attribute is varied with the range of uptake across the four pathways from 23% to 26%. Email access to a healthcare professional is the most consistently preferred option across all subgroups with the exception of 16-18 year olds who would be more likely to choose the pathway with access to a healthcare professional via instant message (IM). Females, and those who have previously tested demonstrate no difference in likely uptake between email and IM, and people in a sexual relationship with one partner demonstrate no difference in likely uptake between IM, email and face-to-face. Again, the exploration of the acceptability of IM and email options to access a healthcare professional in conjunction with eHealth solutions as an alternative to phone access is worthy of further research.

	How you Test	Time to Result	Test Accuracy (False Negative)	Consultation Method	Access to HCP	How you get your Antibiotics
Concept Fully Remote Online Pathway (phone)	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Phone	Collect from pharmacy
Fully Remote Online Pathway with IM access to a healthcare professional	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	IM	Collect from pharmacy
Fully Remote Online Pathway with email access to a healthcare professional	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Email	Collect from pharmacy
Fully Remote Online Pathway with face to face access to a healthcare professional	Self-Test	30 Mins	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Face to Face	Collect from pharmacy

Table 6.40 – Fully Remote Online Pathways exploring access to a healthcare professional

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways										
Phone	23%	23%	23%	23%	23%	24%	23%	23%	23%	23%
IM	25%	25%	26%	26%	25%	25%	25%	25%	26%	25%
Email	26%	26%	26%	25%	26%	26%	26%	25%	26%	26%
Face to Face	25%	25%	24%	23%	25%	25%	24%	25%	25%	24%
Not Test	1%	1%	1%	2%	1%	1%	1%	1%	1%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.41 - Probability of Fully Remote Online Pathway Uptake (varying access to a healthcare professional)

6.6.2 Optimising existing Sexual Health Clinic Pathways

Focusing on the delivery of care via sexual health clinics, the data allow a similar approach to be applied to optimising sexual health clinic pathways in respect of the preferences expressed by young people in the DCE. Considering specifically the access to a health care professional attribute, as non-face-to-face consultation methods are a policy priority (Department of Health, 2011, Department of Health, 2012, NHS England, 2014), tables 6.42 and 6.43 illustrate the use of the DCE results to explore the probability of uptake by varying the levels within this attribute.

As expected, given the lack of statistical significance within the DCE results, the probability of uptake, if the population are presented with each of the four choices are broadly similar. This demonstrates a marginally higher probability of uptake for non-face-to-face access methods, with the exception of the 'in a sexual relationship with one partner' subgroup where face-to-face has the same probability as email. Of interest, in all but one subgroup, the probability of uptake is highest (or tied joint highest) for email as the access option in all subgroups except 16-18 year olds who prefer the IM route. Of the preferred options, it is interesting to note that the options which do not involve speaking to a HCP are preferred over those that do, and, in the case of email, suggests that synchronous communication with an HCP is not a requirement.

	How you Test	Time to Result	Test Accuracy (False Negative)	Consultation Method	Access to HCP	How you get your Antibiotics
Sexual Health Clinic Pathway (Current)	Attend sexual health clinic, sample taken by HCP	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Sexual health clinic	Face to face	Collect from sexual health clinic
Sexual Health Clinic Pathway (Phone)	Attend sexual health clinic, sample taken by HCP	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Sexual health clinic	Phone	Collect from sexual health clinic
Sexual Health Clinic Pathway (IM)	Attend sexual health clinic, sample taken by HCP	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Sexual health clinic	IM	Collect from sexual health clinic
Sexual Health Clinic Pathway (Email)	Attend sexual health clinic, sample taken by HCP	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Sexual health clinic	Email	Collect from sexual health clinic

Table 6.42 - Sexual Health Clinic Pathways exploring access to a healthcare professional

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways										
Face to Face	24%	24%	24%	22%	25%	24%	24%	25%	24%	23%
Phone	23%	22%	23%	22%	22%	23%	22%	23%	23%	22%
IM	24%	24%	25%	25%	24%	24%	24%	24%	25%	24%
Email	25%	25%	25%	24%	26%	25%	25%	25%	25%	25%
Not Test	4%	5%	4%	6%	4%	4%	5%	3%	2%	5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.43 - Probability of Sexual Health Clinic Pathway Uptake (varying access to a healthcare professional)

Considering optimisation of the treatment of chlamydia within the sexual health clinic pathway (as opposed to the whole pathway), there is a notable impact as a result of optimising the three levels relating to treatment – consultation method, access to a healthcare professional and the route for obtaining antibiotics. Table 6.44 shows the make-up of a typical sexual health clinic pathway compared with the pathway with the highest strength of preference for the three treatment levels. Table 6.45 demonstrates that if both pathways were available the uptake of the optimised pathway would be 54% compared with 39% for the current pathway. There is a consistently higher probability across all subgroups analysed.

The significance of this finding is material within the context of delivering sexual health clinic services. Of all of the service options available, the sexual health clinic is the most comprehensive owing to the range of tests it offers and diseases it treats, this cannot currently be replicated in primary care services. Data from PHE shows that of the 1.54 million chlamydia tests undertaken in 2015, 576,089 were in GUM clinic settings and 257,394 were in sexual and reproductive health clinic settings, with a 10.4% and 9.1% positivity rate respectively (Public Health England, 2016a).

The treatment element of the pathway is currently only for patients testing positive for genital chlamydia only. Data on co-infection rates are limited, with one study in an English GUM clinic suggesting that 28% of women testing positive for chlamydia had coexisting STIs (Harindra et al., 2002). This suggests that a high proportion of those testing positive within a clinic setting test positive for chlamydia only and therefore could use the online consultation method or access traditional consultation services via a non-face-to-face method.

	How you Test	Time to Result	Test Accuracy (False Negative)	Consultation Method	Access to HCP	How you get your Antibiotics
Sexual Health Clinic Pathway (Current)	Attend sexual health clinic, sample taken by HCP	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Sexual health clinic	Face to face	Collect from sexual health clinic
Sexual Health Clinic Pathway (Optimised Treatment)	Attend sexual health clinic, sample taken by HCP	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Online consultation	Email	Collect from Pharmacy

Table 6.44 - Sexual Health Clinic Pathways - Optimising the treatment element of the pathway

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways										
Sexual Health Pathway - Current	39%	40%	39%	39%	40%	39%	40%	40%	41%	38%
Sexual Health Pathway - Optimised Treatment Element	54%	52%	55%	51%	55%	55%	52%	55%	55%	53%
Not Test	7%	8%	6%	10%	6%	6%	8%	5%	4%	9%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.45 - Probability of Sexual Health Clinic Pathway Uptake (optimising the treatment element of the pathway)

6.6.3 Optimising the treatment element of existing NCSP Internet Testing Pathways

Considering the optimisation of the treatment element of the NCSP internet testing pathways is a more challenging proposition owing to the considerable variation in pathways across England, this will be explored further in Chapter 7. Focusing on two of the treatment options available – to attend a GP practice or pharmacy for a consultation to get the antibiotics, table 6.46 shows the make-up of the two existing pathways compared with an optimised treatment pathway. This demonstrates that an online consultation with email access to a healthcare professional if required would have a higher uptake than the other two options across the full dataset and all subgroups analysed.

Within the context of treatment uptake rates this finding may be particularly significant for NCSP services where the last data published (2011-12) show significant variation in the range of treatment uptake across screening offices in England with the lowest at 56.2% ranging to 100% (NCSP, 2012b).

	How you Test	Time to Result	Test Accuracy (False Negative)	Consultation Method	Access to HCP	How you get your Antibiotics
NCSP Internet Testing Pathway Current - Pharmacy	Order test kit online, self-sample and post off for analysis	14 Days	5 in 100 people will be told they don't have chlamydia when they do	Pharmacy	Face to face	Collect from pharmacy
NCSP Internet Testing Pathway Current – GP	Order test kit online, self-sample and post off for analysis	14 Days	5 in 100 people will be told they don't have chlamydia when they do	GP	Face to face	Collect from pharmacy
NCSP Internet Testing Pathway – Optimised	Order test kit online, self-sample and post off for analysis	7 Days	5 in 100 people will be told they don't have chlamydia when they do	Online Consultation	Email	Collect from pharmacy

Table 6.46 - NCSP Internet Testing Pathways - Optimising the treatment element of the pathway

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Partner	Prev Test	No Prev Test
Pathways										
NCSP Internet Testing Pathway - Pharmacy	29%	28%	30%	28%	31%	28%	29%	31%	30%	29%
NCSP Internet Testing Pathway GP	30%	30%	30%	31%	29%	29%	30%	30%	30%	30%
NCSP Internet Testing Pathway Optimised	37%	37%	37%	36%	36%	40%	37%	37%	38%	37%
Not Test	4%	4%	3%	5%	3%	3%	4%	3%	2%	4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.47 - Probability of NCSP Internet Testing Pathway Uptake (optimising the treatment element of the pathway)

6.6.4 Impact of Test Parameters

Data from the DCE can also be used to explore the impact of the test parameters to inform the acceptability of new chlamydia testing pathways. Focusing specifically on the first three attributes in the pathway – how you test, how long you wait for your result and test accuracy, analysis can be undertaken to understand the probability of uptake and trade-offs between attributes.

As identified in section 6.5.3 accuracy is consistently the attribute with the strongest preference across all subgroups. Looking specifically at the trade-off between accuracy and time to result, the probability of uptake has been considered for tests with characteristics as the opposite ends of the spectrum, as illustrated in tables 6.48 and 6.49:

	Test Accuracy (False Negative)	Time to Result
Lower accuracy, faster time to result	5 in 100 people will be told they don't have chlamydia when they do	30 mins
Higher accuracy, slower time to result	2 in 100 people will be told they don't have chlamydia when they do	14 Days

Table 6.48 - Trade-off between Accuracy and Time

	Full Dataset	Male	Female	16-18	19-21	22-24	Single	One Part-ner	Prev Test	No Prev Test
Pathways										
5 in 100/ 30min	38%	40%	35%	36%	39%	38%	36%	39%	40%	36%
2 in 100/ 14 days	58%	55%	62%	59%	58%	59%	59%	58%	58%	59%
Not Test	4%	5%	3%	5%	3%	3%	4%	3%	2%	5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.49 - Probability of Uptake (Accuracy & Time)

This suggests that, based on the levels included in the questionnaire, participants are willing to wait considerably longer in order to have a test result with a lower chance of a false negative result. The impact of this for new test development is that time to result is less important than accuracy, and test users are unlikely to use a POCT or self-test with lower accuracy than the options currently available to them.

6.7 Discussion

This study is the first of its kind to offer insights into young people's preferences for new technologies in the testing and treatment of chlamydia. This method enables an understanding of the relative strength of preference between attributes and levels, and can be used by technology developers, policy makers, commissioners and service providers to give a first insight into preferences for new technologies which are currently in development and could be available for use within mainstream services within the next three to five years compared with features of existing products and services. It highlights that accuracy is of critical importance in new test development for young people, with time to result second to this. It also offers valuable insights into how existing pathways can be optimised to increase the probability of uptake.

The study employed a robust method to select the attributes and levels for inclusion based on two literature reviews, focus groups and expert groups, combining the findings using a narrative synthesis to inform the final attribute and level selection. The approach employed to select the attributes and levels aligned with the recommendations of Coast and colleagues, which include ensuring attributes are "manipulable in policy" (Coast et al., 2012:739), the conduct of piloting, ensuring that 'meaningful language' is used, clarity on the 'methodological choices' to develop attributes for the DCE and that the reporting of attribute selection is transparent (Coast et al., 2012).

The study had a sufficiently large sample size to enable split sample analysis and subsequent comparison between a number of subgroups including gender, age range, previous testing history and two relationship categories. Participants were drawn from the general population rather than via health care settings thus enabling access to a population who had not previously tested for an STI before, setting it apart from much of the previous research which focused on service users. This general population sample enables consideration of the preferences of those who have not used STI testing services and therefore offers insight into their preferences, thus informing the development of services which they may be more inclined to use.

The use of an online panel provided analytics data to support the validity tests employed for the DCE. The accurate record of time taken to complete the survey enabled validity checks, which would not have otherwise been possible with a written questionnaire response. However, the use of an online panel may limit the generalisability of the findings to other populations and over-represent the acceptability of online care.

Given the breadth of sample achieved via the online panel as outlined in section 6.5.1 and the high proportion (97%) of 15-24 year olds accessing the internet daily via a mobile device (ONS, 2016a) and owning a smartphone (Ipsos Media CT, 2016) this demonstrates that the majority of the population have access to the base technology to use a fully remote online pathway for the testing and treatment of chlamydia if they choose to do so.

A number of limitations were identified whilst undertaking this research. The first relates to the selection of attributes and levels. Whilst it is identified that a strength of the process is the rigour employed in the selection process of attributes and levels, this cannot detract from the higher absolute number of attributes that are involved in a chlamydia testing and treatment pathway, and how these might impact on individual choices. To address this, where known attributes were excluded, as reported in section 5.4.5, information was included in the background to minimise the risk associated with respondents forming their own views on the impact of these attributes on the pathway. Range of STI tests was identified as a significant factor by the focus groups during the research to select the attributes and levels included within the questionnaire. However, due to practicalities in the design and implementation of the DCE it was not possible to incorporate this attribute into the final DCE without compromising the results. Key to this is what the respondent was considering at the time they complete the questionnaire, for example, which STI were they thinking of when completing the questionnaire. The focus groups touched on this with an indication that their choices may be different, for example if thinking about HIV, or thinking that their test result will be positive.

A second limitation identified relates to the difference in respondent feedback between the cognitive testing and final DCE respondents. Whilst the cognitive testing did not indicate that participants found the questionnaire repetitive during the testing phase, respondents to the final DCE cited this in their qualitative feedback to the research company. The design of the DCE did allow for a number of options, as outlined in section 6.5.2.5, which may mean that options for future research include blocking the design to three questionnaires to reduce the number of choice sets to 17 (16 plus consistency check).

The final limitation identified was the model selected for analysing the DCE results. Methodological publications (Louviere et al., 2000, Ryan et al., 2008, Hauber et al., 2016) indicate a number of models which to be used for the analysis of DCE results which allow for both the partial and full relaxation of the IIA. Whilst it is recognised that the MNL model used is the 'workhorse' for DCE analysis, it was beyond the scope of this research to explore the comparisons in outcomes resulting from the analysis of the results in a range of models. It is recognised that, particularly because of the 'I would not test option', there are other modelling approaches that it may be of further benefit to explore. Of the MNL approaches, the nested logit model, which groups "subsets of alternatives that are more similar to each other with respect to excluded characteristics than they are to other alternatives" (Ryan et al., 2008:28) is one that warrants further investigation. However, this does not allow for the full extent of other modelling approaches such as latent class modelling which enables relaxation of the IIA assumption and consideration of random taste variation (ibid.).

Of the other stated preference studies identified in the literature review in section 4.2 it is difficult to draw a direct comparison in respect of the findings because of the variance in study objectives relating to the testing and treatment of STIs, and range of attributes and levels included. Miners and colleagues (2012), and Llewellyn and colleagues (2013) have conducted the only other DCEs exploring preferences for sexual health services in England however focus on preferences within traditional service delivery models rather than considering the use of new technologies. These DCEs are also general in respect of looking at preferences for sexual health services, rather than focusing on one STI. It is not known when expressing their preferences how participants have been directed to consider what STI they may have. As identified in the focus groups with young people and expert groups the range of tests is an important consideration in making a decision to test however the variance in treatment pathways for positive STI test results is significant in so far as the ability to conduct a DCE across a full pathway.

In their exploration of the preferences for chlamydia screening in family planning clinics Watson and colleagues identified that screening at a family planning clinic increases the preference for screening whilst screening at home "is significant and negative, implying a negative effect on screening preference" (Watson et al., 2009:622). This is at odds with the finding within this study which indicates significant positive preferences for both self-testing, and self-sampling and posting the result to a laboratory for analysis. Reviewing the studies included in the second literature review to identify a comprehensive list of attributes for the focus groups, there are no studies which consider the new technologies included within the DCE.

Subsequent to the literature review of stated preference studies outlined in Chapter 4, a refresh of the literature search to December 2016 has identified two further papers have been published meeting the inclusion criteria, one exploring vaginal microbicide preferences (Primrose et al., 2016) and one exploring patient preferences for HIV clinic appointments (Miners et al., 2016). Miners and colleagues found that patients living with HIV had a stronger preference for shorter waiting times, however latent class modelling demonstrated the two groups had differing preferences for HIV clinic and GP appointments (Miners et al., 2016).

Considering the findings of this study within the context of the national policy direction of increasing digital access (NHS England, 2014), and reducing face-to-face appointments (Department of Health, 2011), it is interesting to note that whilst the lack of clear preference does not inform the redesign of pathways from the perspective of increasing uptake, the ambivalence suggests that alternative, more cost-efficient methods could be employed to redirect clinical staff time e.g. achieving economies of scale by offering IM and email solutions over a larger geographic area.

Within the context of sexual health policy and commissioning sexual health services, this DCE provides some evidence to support the policy direction of remote testing and treatment options. It offers commissioners insight into how young people may respond to changes to pathways and the introduction of new technologies. This information will be beneficial in informing piloting of new service models. However, in respect of the fully remote online pathway it is important to note that although the characteristics of this pathway demonstrate that should it exist the probability of uptake is higher than that of conventional sexual health and NCSP internet testing pathways for chlamydia, there is still a proportion of the population who would use these services.

This suggests that whilst new technology has a role to play in increasing uptake, it is most likely as an additional rather than replacement option.

For technology developers the DCE highlights important considerations for test development, namely the strength of preference for test accuracy over other product characteristics included within the DCE. From the perspective of the delivery of online treatment pathways it suggests that consideration should be given to other methods of contacting a healthcare professional for advice if necessary, particularly email and IM.

There are a number of questions that the DCE does not answer, which are important considerations in the adoption of new technology into sexual health services. Firstly, the study is only applicable to chlamydia. Recognising that range of STIs to be tested for is an important issue for young people in choosing to test, further research is required to understand preferences within the context of other STIs to ensure that this is recognised in future service pathways. The complexities of options relating to testing and treatment, in particular what can be delivered safely and effectively remotely mean that a very different selection of attributes and levels would be required to consider this which would not be able to consider the detailed pathway elements that this DCE has done.

Secondly the DCE did not include a cost attribute. This was a choice made during the design phase of the research as it is a legal requirement that local authorities provide open access STI testing and treatment services, therefore under current legislation users will never pay a fee to use the service. However, the costs from a user perspective are notably different for different service options in terms of their time and resources e.g. time off work, travel, phone, internet access etc. Further research to explore a user cost attribute may add to the understanding of the impact of this factor on service uptake.

Preferences for self-testing and eHealth solutions within the context of other STIs is one of a number of potential areas for future research. The DCE has also identified a number of other considerations for future research in respect of service delivery models, as well as some considerations for further research in respect of the DCE methodology. In respect of service delivery models, as outlined previously, two of the areas warranting further exploration are the routes of access to a healthcare professional in the delivery of treatment consultations, and the use of postal solutions for the provision of drugs.

In respect of methodological considerations, a number of issues where there is an absence of consensus on the most appropriate approach have been identified which may warrant further exploration to improve consistency in the application of the method. Firstly, the number of choice sets included in the DCE. The online panel feedback indicated that participants found it repetitive, whereas this was not a theme identified at the cognitive testing stage. Understanding the extent of the impact of the number of choice sets within the questionnaire in respect of the internal validity checks at the pilot stage could also inform the final questionnaire design.

A second issue identified related to the use of repeated choice sets. Both the absence of consensus on which choice set the data should be retained from and whether there is a threshold at which inconsistent responses between the repeated choice set could be explored further to consider whether it is possible to establish good practice guidelines.

6.8 Summary

The DCE has identified that the strongest attribute affecting young people's preferences for chlamydia testing and treatment was test accuracy, followed by time to result. The results demonstrated a general preference for remote pathway options, including self-testing and self-sampling and posting the sample for analysis over attending a healthcare setting for testing. This is also reflected in treatment preferences, with participants indicating a general preference for online consultation to consultation via GP, pharmacy or a sexual health clinic. Little difference was observed between face-to-face, telephone, email or instant messaging for accessing a healthcare professional. Interestingly the preference for remote options did not hold true for this attribute, with face-to-face contact being preferable to telephone access to a healthcare professional. Finally, there was no significant difference in preference for antibiotic provision.

Exploring the optimisation of pathways has demonstrated the potential impact of levels on the uptake of services, both in terms of new pathways, and by optimising existing pathways, demonstrating the potential impact that substituting alternative options into existing pathways may have. The findings suggest that should an OCCP or fully remote online pathway be available a higher proportion of young people would choose to use that than existing options.

The next chapter, Chapter 7, considers the costs and benefits of implementing eHealth clinics for the treatment of chlamydia and Chapter 8 builds on this, taking forward the work of Chapter 7 into a preliminary economic evaluation of the OCCP and a fully remote online pathway and utilises the DCE coefficients identified in this chapter to explore the impact of pathway uptake on the costs and outcomes of asymptomatic chlamydia testing and treatment.

CHAPTER 7 – EXPLORING THE COSTS AND CONSEQUENCES OF IMPLEMENTING eHEALTH CLINICS FOR THE TREATMENT OF CHLAMYDIA

7.1 Introduction

This chapter presents the findings of a literature review exploring the costs and cost-effectiveness of chlamydia testing and treatment in the UK and the primary costing of the OCCP developed by the eSTI[2] research consortium to inform a preliminary assessment of the costs and consequences. The purpose of the study was to assess the likely impact on costs of the introduction of the OCCP into mainstream sexual health services. This chapter therefore centres on the eHealth clinic component of the pathway only. In the following chapter the adoption of a fully remote online pathway (Pathway E, figure 2.1) will be considered in a decision analytic model. Within the frameworks of product development, HTA and economic evaluation outlined in table 3.5 the OCCP can be categorised at stage 2 in its development – translational research, early health technology assessment, maturing innovation. This classification of the technology has been used to inform the selection of methods to address the identified primary research aim: *to assess the impact on costs of OCCP introduction into mainstream sexual health services.*

Identified secondary objectives are:

- To identify the key issues in costing the OCCP
- To review data on consequences and present a preliminary cost consequence analysis.

Figure 7.1 illustrates the scope of the pathways included in the costing study. This starts at results notification and concludes following health advisor follow up (indicated by the orange shading). The three pathways included are GUM clinic and NCSP internet testing pathways (the comparator pathways) and the OCCP. For this exploratory study, in the absence of a self-test, results notification was undertaken by participants logging into the eHealth clinic to get their results. The model presented in Chapter 8 includes the full pathway.

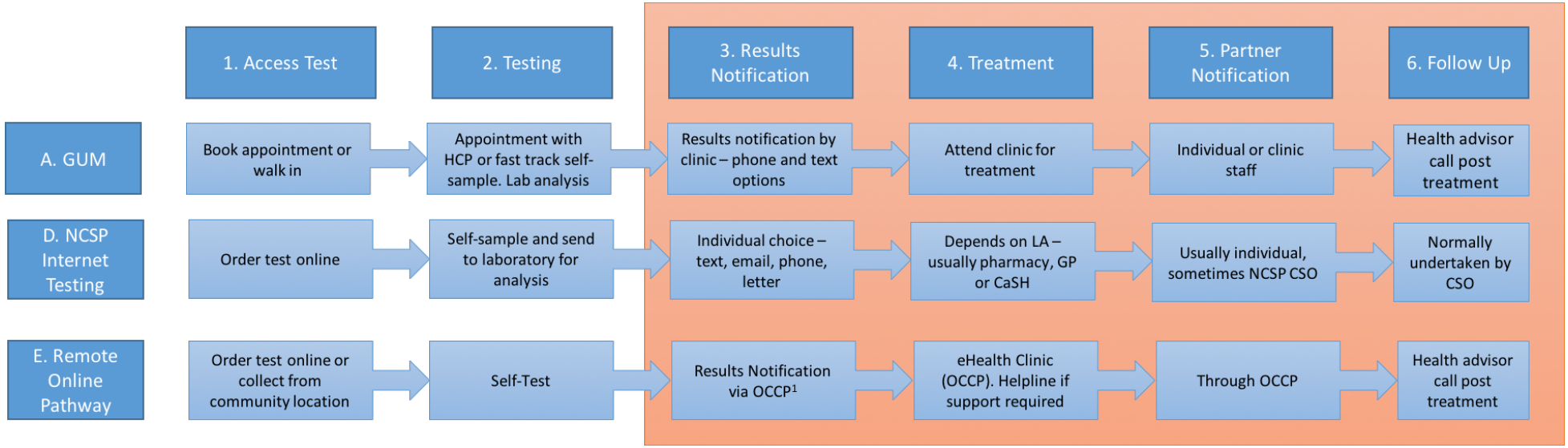

Figure 7.1 - Scope of pathways included in the costing study

[1] – For the OCCP exploratory study, owing the absence of a self-test, results notification was undertaken via the OCCP. Following a text, patients logged into the OCCP to access their results.

7.2 Methods used to Identify the Costs and Consequences of eHealth Clinics for Chlamydia

7.2.1 Identification of Costs

This section builds on the high level introduction to the methods adopted and the rationale for their selection in section 3.5.1, setting out the detailed methods adopted to cost the pathways included in the costing study.

7.2.1.1 Definition of Decision Problem and Objectives of Costing

Mogyorosy & Smith identified in their literature review that the definition of the decision problem has an impact on all subsequent decisions in the evaluation (Mogyorosy & Smith, 2005). This stage includes the following components: identification of decision problem and objectives, the perspective of costing and the time horizon (ibid.) These are considered in the following sections.

The decision problem within this study was framed within the context of eHTA: to quantify the likely costs and outcomes of the OCCP in comparison with GUM and NCSP internet testing pathways. Drummond and colleagues identify a number of perspectives that can be applied in both the selection of costs and consequences including the individual, healthcare providers, healthcare purchasers and societal (Drummond et al., 2015). They propose that the perspective taken should reflect the perspective of the audience intended to be informed by the economic evaluation (ibid.). It was determined that the pathways would be costed from the perspective of a healthcare provider as the aim of the research is to assess the impact on costs of the adoption of the OCCP into mainstream sexual health services, this is in line with the MTEP defined approach (NICE, 2011).

The consideration of the costs and consequences of the intervention for the immediate outcomes (process measures which reflect uptake of services) is beneficial to both commissioners and providers. Commissioners because the separation of commissioning responsibilities outlined in section 2.4.2 means that they are responsible for the testing and treatment services, and providers because similarly the organisation of services is such that the clinical management of health complications would take place in other services. Therefore, their focus will be on understanding the impact within their service pathways.

7.2.1.2 Description of Service Being Costed

Figure 7.1 sets out the pathways for the testing and treatment of chlamydia and the elements of the pathway included in the costing study. The section of the pathway to be costed reflects the elements provided by the OCCP. In their literature review, Mogyorosy and Smith summarise the key considerations for defining health services for costing, those relevant for this study are presented in table 7.1, along with their definition:

Service Definition Criteria	OCCP	GUM Pathway	NCSP Internet Testing Pathway
Target Population	Males and females aged 16 plus, testing positive for genital chlamydia trachomatis only		
Type of Facility	Treatment – online Drugs – collect from pharmacy	Treatment - GUM Clinic Drugs – provided at Clinic	Treatment – varies between areas: Pharmacy, GP, CaSH, GUM Drugs – GUM & CaSH – provided at clinic, GP & Pharmacy – community pharmacy
Location of Facilities	London Service	London Service Urban/ Semi-Rural Service	London Service Urban/ Semi-Rural Service
Service Intensity	As target population		
Service Mix	Online service	Primarily hospital delivered	Primarily community and primary care delivered

Service Definition Criteria	OCCP	GUM Pathway	NCSP Internet Testing Pathway
Average Workload by Provider	Within context of economic evaluation solely case mix related to patients eligible to participate in exploratory study are considered.		
Treatment of Adverse Events	Referral to GUM	Managed in service	Referral to GUM
Type of Hotel Functions Used	Identified and costed as part of the pathway mapping interviews		
Quality & Grade of HCP staff involved	Multiple potential different HCP staff involved as service can be delivered by doctors, nurses and pharmacists		
Provision of Non-Medical Elements of the Service	Not applicable		
Criteria of discharge or transfer	Not applicable		
Payment mechanism[6]	Assumed to be cost per case across all services. Not directly relevant to costing study as healthcare provider perspective adopted		
Source of Payment	Local Authority	Local Authority	Local Authority

Table 7.1 - Description of Service being Costed (adopted from Mogyorosy and Smith, 2005)

7.2.1.3 Identification of Resource Items and Units of Measure

As previously identified, the perspective for the analysis is the healthcare provider; this perspective informs the selection of costs to be considered within the analysis (Drummond et al., 2015). The second variable which influences the approach to identifying resource items is the approach taken to costing (Gray et al., 2011). This is represented on a scale of precision by Drummond and colleagues, adapted in figure 7.3:

6 - Payment Mechanism – the basis on which the healthcare provider is paid e.g. cost per case (tariff), block contract (fixed value for all activity undertaken)

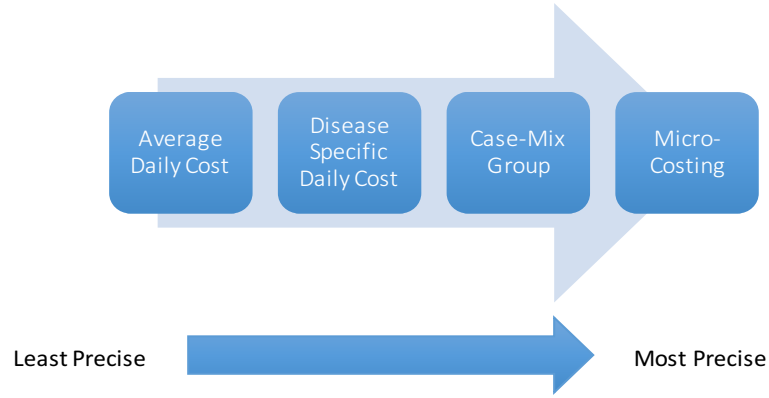

Figure 7.2 - Levels of Precision in Healthcare Costing, adapted from Drummond et al., 2015:240

Once determined, the level of precision is then relevant for the next two stages of costing (ibid.). Brouwer and colleagues recognise that in practice the majority of economic evaluations use a combination of these approaches (Brouwer et al., 2001). This pragmatic approach was adopted in the OCCP costing study. For the costing of the OCCP, which is not currently in mainstream practice, a micro-costing approach has been adopted, taking data from the exploratory study to inform the costing of the pathway. The cost data was derived from:

- Records kept as part of the study,
- Data captured within the clinical system,
- Data recorded by the study's heath advisor,
- Semi-structured interviews with staff involved in the trial delivery.

There was one major adaption made to the pathway to enable prescribing of azithromycin in the exploratory study. Owing to legal constraints on the use of the electronic prescribing system, pre-pack azithromycin was provided to community pharmacies to dispense. In order to provide a costing comparative to current pathways, this has been costed based on delivery within mainstream practice rather than the study scenario.

This approach is in line with the type of economic evaluation for stage II of technology development identified by Sculpher and colleagues (Sculpher et al., 1997). They recognise that in respect of the identification of costs there is greater access to "individual patient data on the costs and outcomes of the new technology" however that "stage II estimates of cost effectiveness are unlikely to be definitive" (Sculpher et al., 1997:27).

Tate and colleagues highlight a number of issues in identifying the costs for online interventions. These include sunk costs – internet interventions often have a large upfront non-recurrent cost that relate to the development of the technology and the useful life of the intervention – how long it can exist without the need to update/ upgrade (Tate et al., 2009). They clarify that sunk costs should not be included in economic evaluation as they would not recur if the intervention were implemented on a larger scale, and that future costs for updating the technology should be included (ibid). In addition, they address the issue of how the fixed costs of internet interventions (e.g. website hosting and maintenance) should be addressed. Their recommendation is that the likely uptake of the internet intervention should be estimated and the fixed cost converted to a per patient cost to enable comparison (ibid). Their recommendations have been adopted in the OCCP costing study.

In order to enable the identification of resource items for the comparator pathways, a literature review has been undertaken to identify studies reporting the costs and cost-effectiveness of elements of the chlamydia testing and treatment pathway in the UK. The methods and findings are presented in section 7.3. This review identified sufficient information to cost the pathway from a GUM clinic perspective. However, gaps in the literature did not allow an establishment of costs for a comparative GUM clinic and NCSP internet testing pathways.

To address this, a primary costing study was developed and undertaken to collect information on GUM and NCSP internet testing pathways to enable establishment of the reference cases for comparison with the OCCP. This included semi-structured interviews with commissioners initially, and follow up interviews with service providers. The objectives of the study were to:

- Map the GUM testing pathway – to gain a detailed understanding of and identify resource items and units of measure for the delivery of the asymptomatic chlamydia treatment pathway,
- Map the NCSP internet testing pathway – to gain a detailed understanding of and identify resource items and units of measure for the delivery of the chlamydia treatment pathway,
- Identify the contractual arrangements surrounding this – to understand the contractual arrangements of the pathway, for example whether the full pathway is provided in house or elements are sub-contracted to other providers,
- Identify performance data – to identify data for the key process measures relating to the pathway e.g. treatment uptake, partner notification rate.

Recognising the difference in healthcare delivery models between London and other parts of England, the study costed one GUM pathway (outside of London), and two NCSP internet testing pathways (one in London, one outside of London). A GUM pathway in London was not costed because access to study participants in London was challenging owing to a major re-procurement exercise being undertaken by the London Local Authorities in 2015-16.

Interviews were selected over other methods such as postal surveys because a written questionnaire response would have been laborious for participants to complete, owing to the number of supplementary questions which would be required in a written questionnaire. These could be managed more effectively in an interview.

Standard process mapping techniques endorsed by the NHS Institute for Innovation and Improvement (NHS Institute for Innovation and Improvement, 2013) were used as the basis for interview schedules (for an example see Appendix 15). Interview schedules were tailored to commissioners and providers, adapted depending on responses from previous interviews.

7.2.1.4 Measurement of Resource Use

"Ideally, resource utilisation measurement should be comprehensive, reliable, valid and representative" (Mogyorosy & Smith, 2005:47). The scale of precision proposed by Drummond and colleagues is equally as applicable to resource unit measurement as it is to the identification of costs (Drummond et al., 2015). Mirroring the scale of precision, there are a range of approaches to measurement of resource use.

Brouwer and colleagues highlight a number of issues to consider in the collection of resource use data including "the perspective of the study, the requirements for representativeness and generalisability, the (expected) impact of the specific resource item on total or incremental costs, and the availability of existing data and the effort needed to collect additional data" (Brouwer et al., 2001:73).

Mogyorosy and Smith summarise a range of techniques and their advantages and disadvantages in their literature review. These include time and motion studies, manager surveys, service use questionnaires and interviews, medical case record review, account classification, self-reported activity logs, postal surveys, self-reported questionnaires, cost diaries, relative value scale approach and diagnostic related groups (Mogyorosy and Smith, 2005).

A number of techniques have been used to measure the resource inputs in the OCCP costing study; these are summarised in table 7.2:

Pathway	Resource Unit Measurement Used
OCCP	• Resource data captured as part of the exploratory study • Interviews with health advisor and supervisory clinician • Review of budget statements
GUM Clinic	• Previously published study • Interview with lead nurse, service manager and accountant • Review of budget statements
NCSP Internet Testing Pathway	• Interview with service lead, commissioning lead, pharmacist and accountant • Review of budget statements

Table 7.2 - Summary of Resource Unit Measurement Techniques Used

It can be seen that the techniques used in the OCCP costing study align to the micro costing end of the spectrum of precision. The benefits of the approach taken are that the data are easily accessible and provide an indicative measure of resource use from people with a high degree of knowledge about how the service is delivered, without the intensive input required to undertake individual activity based costing through time and motion studies and individual patient costing (Mogyorosy and Smith, 2005).

7.2.1.5 Assignment of Monetary Values to Resources

There are a range of national data sources which can be used to assign monetary values in the UK. These include reference costs, unit costs of health and social care and the NHS electronic drug tariff (Drummond et al., 2015, Gray et al., 2011, McIntosh et al., 2010, PSSRU, 2015, Department of Health, 2015).

The data sources selected to cost the pathways are summarised in table 7.3. The detail for every unit cost included in the costing study is summarised in section 7.6.1.

Cost Type	Data Source
Staff Costs	Unit Costs of Health and Social Care 2015 (PSSRU, 2015)
Consumable Costs	Identified as part of costing exercise
Drugs Costs	NHS Electronic Drug Tariff (primary care) Hospital pharmacy (secondary care)

Table 7.3 - Summary of Data Sources for Costing

The decision to use these data sources was made based on the approach taken to costing, as using reference costs would not enable costing with sufficient accuracy because the specification of the reference cost does not map onto to units in which elements of the pathway are costed. The activity was costed at 2015 prices (£GBP); where necessary the NHS Hospital and Community Health Services (HCHS) pay and prices inflation index (Department of Health, 2016a) was applied to inflate costs to current prices.

7.2.2 Identification of Consequences

The study protocol for the OCCP exploratory study identified the clinical outcome measures set out in table 7.4:

Primary Outcome Measure
"The proportion of people who test positive for genital *C.trachomatis* infection (index patients) and the proportion of those who are managed through the *eSTI*^{2} *clinical care pathway* who receive appropriate clinical management*. *as defined by BASHH National Standards for management of genital *C.trachomatis*."
Secondary Outcome Measures
"Proportion of index patients who receive antibiotic treatment solely through the electronic element of the *eSTI*^{2} *chlamydia clinical care pathway.* Time from index patient receiving diagnosis to receiving appropriate treatment. Proportion of sex partners treated. Time from index patient receiving diagnosis to sex partner receiving appropriate treatment."

Table 7.4 - Outcome Measures for the eSTI2 Proof of Concept Study (eSTI^2, 2013:10)

Whilst identified in the study protocol for the exploratory study as clinical outcome measures it is important to note these are not health outcome measures, they are process measures. As outlined in section 3.5.1 these are also important considerations in the evaluation of complex interventions, and are defined within the NICE MTEP guidance as system outcomes "a non-clinical outcome, typically impacting on resource capacity, resulting from a clinical (patient-level) treatment episode" (NICE, 2011:28).

These outcomes are suitable for considering the short-term consequences of the adoption of the eHealth clinic, i.e. compared with the delivery of routine treatment for chlamydia through GUM and NCSP internet testing pathways:

- Does the treatment uptake rate increase?
- Does the partner notification rate increase?
- Does the time to treatment decrease?

All of the intermediate (process) outcomes are important in considering the final outcomes for chlamydia treatment, recognised primarily as health complications arising from untreated chlamydia (also known as major outcomes). These include PID, ectopic pregnancy, infertility, PROM, neonatal pneumonia and conjunctivitis, epididymitis in men. These will be explored further in Chapter 8.

The decision to use intermediate (process/system) outcomes alongside the costing study reflects that the consequences of untreated chlamydia can go undetected for a number of years, however process-based outcomes offer insight into the immediate impact of the pathway change. This also aligns to Pietzsch and Paté-Cornell's view of the scope of eHTA, particularly the decision support function for developers to design and develop/manufacture the new technology (Pietzsch and Paté-Cornell, 2008). The intermediate outcomes centre on the direct changes (both positive and negative) to the service pathway.

To identify the outcomes for patients participating in the OCCP exploratory study, the system was designed to capture information on the outcome measures listed in table 7.4. To identify the outcome measures for the comparator pathways, two literature searches were undertaken, the first to identify studies published since 2005 which consider the costs or cost-effectiveness of chlamydia testing and treatment in the UK and the second to identify published studies providing data on outcomes. The search strategies and results of the literature reviews are presented in sections 7.3 and 7.4 respectively.

7.3 Literature Review – Costs and Cost Effectiveness of Chlamydia Testing and Treatment in the UK

The objective of the literature review was to identify and evaluate published studies exploring the costs and cost-effectiveness of the chlamydia testing and treatment in the UK to:

- Identify relevant resource items, units of measure and costs for the OCCP costing study,
- Examine the economic models used to consider cost-effectiveness
- Identify the outcomes used in modelling cost-effectiveness.

The inclusion criteria were identified as:

- any cost-effectiveness or costing study within the scope of STI testing and treatment services. This includes both chlamydia screening and chlamydia testing delivered in sexual health clinics
- studies published between 2005 and 2015. This date range was selected to reflect the significant changes in the delivery of sexual health services in England, summarised in section 2.4.1.

The exclusion criteria were identified as studies:

- not related to humans
- not published in English
- from outside of the UK
- that do not relate to the costs or cost-effectiveness of an aspect of the chlamydia testing and treatment pathway as defined in section 2.4.4.

7.3.1 Search Strategy

The following databases were searched on 22 February 2015 to identify studies published to the end of 2014 and were re-run in April 2016 to search for any studies published between 1 January – 31 December 2015:

- Medline
- EMBASE
- PROQUEST – Theses & Dissertation Search
- Econlit
- Cochrane Library (incorporating the following databases):
    - Cochrane Database of Systematic Reviews
    - Cochrane Central Register of Controlled Trials
    - Cochrane Methodology Register
    - Database of Abstracts of Reviews of Effects
    - Health Technology Assessment Database
    - NHS Economic Evaluation Database.

The key search terms and their abbreviated database entry (where applicable, abbreviation example from Medline) are summarised in table 7.5, the full Medline search is included in Appendix 16. Search terms were identified from books and papers outlining methods for economic evaluation and systematic reviews of economic evaluation (Drummond et al., 2005, Mistry, 2011). Searches were structured in the databases to meet the search requirements of the respective database and terms expanded where the facility existed to do this. The use of expanded terms, in particular "cost benefit analysis" and "costs and cost analysis" which include key terms such as: cost, cost analysis, cost comparison, cost measures and costs and benefits enabled the search to capture relevant costing studies as well as economic evaluations.

Category	Search Terms Entered
Chlamydia	Chlamydia Chlamydia Trachomatis
	AND
Economic Evaluation	Cost effective Cost benefit Cost utility Cost minimi* Cost consequence CEA CBA CUA CMA CCA Economic analys* Economic evaluation Economic model* Cost analys* Costs

Table 7.5 - Search Terms taken from the Medline Search

The results were imported into Endnote x7 for Mac and duplicates removed. The titles and abstracts were reviewed and studies excluded for the following reasons:

- Not an economic evaluation or costing study. Note studies which incorporated both clinical and cost effectiveness were included
- Study did not focus on chlamydia
- Not a study/ systematic review e.g. abstract only, study protocol
- Study not conducted in the UK.

To assess the quality of retrieved articles, a number of checklists were identified including that by Drummond and colleagues (2005), the Critical Appraisal Skills Programme (2013) and the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) Statement (Husereau et al., 2013).

There are a number of similarities between the three however the CHEERS statement was selected as reporting checklists are designed to facilitate the reporting of full information about the study in articles, whereas appraisal tools are designed to assess the adequacy of methods (Altman, 2013). For costing studies, no reporting checklist was identified; therefore the CHEERS checklist was used with criteria not applicable to costing studies (six items) removed.

7.3.2 Search Results

The initial search identified 600 records and 59 duplicates were removed in Endnote leaving 541 for initial review. The re-run of the searches to identify studies published in 2015 identified 71 records and 17 duplicates were removed, leaving 54 for initial review. The titles and abstracts were reviewed for each exclusion criterion in turn; leaving a total of 21 studies that met the inclusion criteria for full review.

The search results are illustrated in the PRISMA flowchart, figure 7.3:

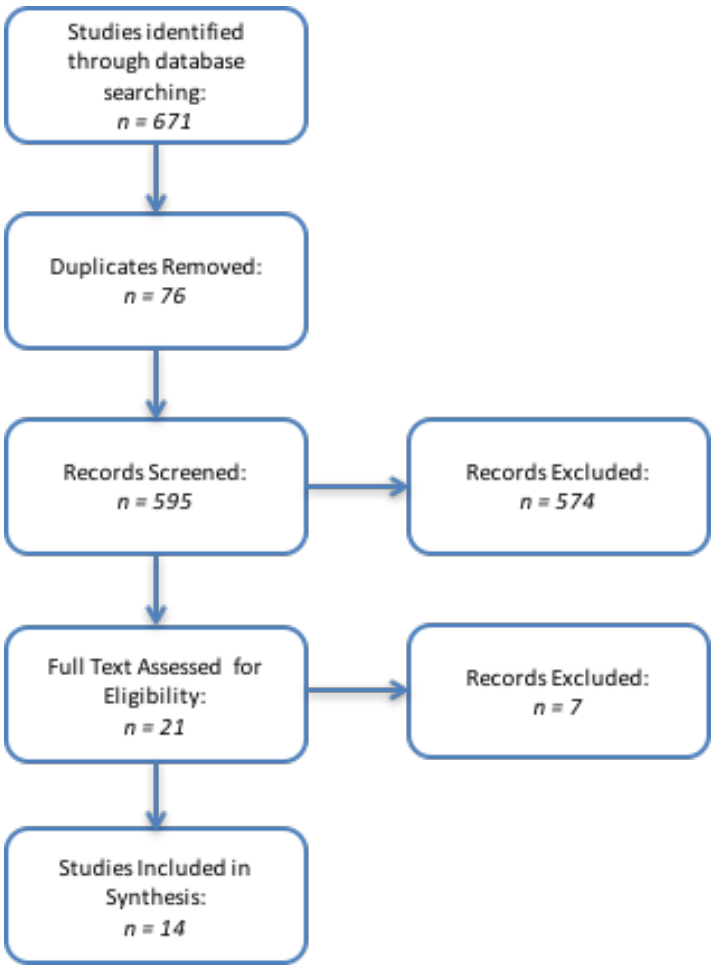

Figure 7.3 - PRISMA Flowchart

The reasons for the exclusion of studies at the screening stage are summarised in table 7.6:

Reasons for Exclusion at Screening Stage	Number of Studies Excluded
Not an economic evaluation or costing study	453
Study does not include Chlamydia	30
Not a study/ systematic review e.g. abstract only, study protocol	30
Study not in the UK	61

Table 7.6 - Reasons for Exclusion of Papers at Screening Stage

A further seven studies were excluded at the full text review:

Reasons for Exclusion at Full Text Review	Number of Studies Excluded
Systematic or other literature review – all included UK studies outside of date range	3
PhD Thesis – Study Reported in Publication Included in Review	2
Study outside of UK – not identified from abstract	1
Systematic review – not including any element of chlamydia testing and treatment pathway	1

Table 7.7 - Studies excluded after full text review

7.3.3 Data Extraction

The data extraction form was designed to take into account the review question, adopting the approach outlined in section 4.3.4. Data were extracted into an electronic template prepared in Excel for Mac 2010.

7.3.4 Key Findings

In total 14 studies met the inclusion criteria; three studies had a focus on chlamydia testing (Hislop et al., 2010, Jackson et al., 2015 and Turner et al., 2014), four studies focused on partner notification (Althaus et al., 2014, Cassell et al., 2015, Low et al., 2006 and Roberts et al., 2012), and seven studies took a broad overview of a chlamydia testing and treatment pathway (Adams et al., 2007, Bracebridge et al., 2012, Kelly et al., 2014, Looker et al., 2015, Low et al., 2007, Robinson et al., 2007 and Turner et al., 2011). A summary of the studies included in the review is presented in table 7.8.

Ref	Author	Study Focus	Type of Study	Country of Study	Standalone Reporting/ Integrated with Clinical Effectiveness	New Technology?
1.	Adams et al. (2007)	Opportunistic Chlamydia Screening	CEA	England	Standalone	No
2.	Althaus et al. (2014)	Partner Notification technologies	CEA	England	HTA containing standalone economic evaluation	Yes
3.	Bracebridge et al. (2012)	Postal Chlamydia screening and treatment	CCA	England	Integrated	No
4.	Cassell et al. (2015)	Partner Notification	Cost Analysis	England	HTA containing standalone economic evaluation	Yes
5.	Hislop et al. (2010)	Rapid POCT for Chlamydia testing	CCA & CEA	England	HTA containing standalone economic evaluation	Yes
6.	Jackson et al. (2015)	Chlamydia Screening in Football Club Settings	CCA	England	Standalone	No
7.	Kelly et al. (2014)	Chlamydia Testing within primary care level 1 sexual health service	Cost Analysis	Northern Ireland	Integrated	No
8.	Looker et al. (2015)	Chlamydia Testing	CEA	Scotland	Standalone	No
9.	Low et al. (2006)	Partner Notification	CCA	England	Integrated	No
10.	Low et al. (2007)	Proactive Chlamydia Screening	CEA	England	HTA containing standalone economic evaluation	No
11.	Roberts et al. (2012)	Accelerated Partner Therapy	CCA	England	Standalone	Yes
12.	Robinson et al. (2007)	Proactive Chlamydia Screening	Cost Analysis	England	Standalone	No
13.	Turner et al. (2011)	Chlamydia Screening & Partner Notification	CEA	England	Standalone	No
14.	Turner et al., (2014)	Chlamydia POCT	CEA	England	Integrated	Yes

Table 7.8 - Summary of Included Studies

Of the 14 included studies, three were cost analyses, seven cost effectiveness analyses and five cost consequence analyses (one study included both a cost effectiveness analysis and a cost consequence analysis, Hislop et al., 2010) as identified in table 7.8. Six studies were standalone economic evaluations, four were integrated with a clinical, product or service evaluation and four were economic evaluations within HTA reports. Five studies introduced a new technology into their costing study/ economic evaluation:

- Three relating to partner notification (Althaus et al 2014., Cassell et al., 2015 and Roberts et al., 2012),
- Two relating to rapid point of care testing for chlamydia, one using EIA in a family planning setting (Hislop et al., 2010), and one using NAAT in a GUM clinic setting (Turner et al., 2014).

The remaining nine studies were pathway related. Four studies considered the introduction of chlamydia screening (Adams et al., 2007, Looker et al., 2015, Low et al., 2015, Robinson et al., 2007), and the final five looked at the impact of changes to the chlamydia screening pathways including:

- a fully remote postal testing pathway (Bracebridge et al., 2012),
- chlamydia screening in football club settings (Jackson et al., 2015),
- establishing chlamydia testing within a level 1 primary care service (Kelly et al., 2014),
- changes to the delivery of partner notification method (Low et al., 2006),
- changes to intervention strategies (Turner et al., 2011).

7.3.5 Quality Assessment

Each article was assessed against the relevant sections of the CHEERS checklist and evidence inputted into the data extraction sheet. The findings were then summarised to indicate whether there was evidence of full, partial or no achievement of the indicator, or whether this was not applicable where it was possible to determine this from the article. The outcome of this exercise is summarised in table 7.9.

CHEERS Checklist Criteria	Adams et al., (2007)	Althaus et al., (2014)	Bracebridge et al., (2012)	Cassell et al., (2015)	Hislop et al., (2010)	Jackson et al., (2015)	Kelly et al., (2014)	Looker et al., (2015)	Low et al., (2006)	Low et al., (2007)	Roberts et al., (2012)	Robinson et al., (2007)	Turner et al., (2011)	Turner et al., (2014)
Title & Abstract														
1. Title identifies study as economic evaluation	✓	✓	×	✓	✓	✓	×	✓	×	✓	✓	✓	✓	✓
2. Abstract	✓	✓	✓	*p*	*p*	✓	*p*	*p*	*p*	*p*	✓	✓	✓	✓
Introduction														
3. Background & Objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Methods														
4. Target Population & Subgroups	✓	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. Setting & Location	✓	✓	✓	✓	✓	✓	✓	✓	✓	*p*	✓	✓	✓	✓
6. Study Perspective	✓	✓	*p*	✓	✓	✓	×	×	×	×	✓	✓	✓	✓
7. Comparators	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	*n/a*	✓	✓
8. Time Horizon	✓	×	×	×	✓	×	×	*p*	×	✓	×	×	×	×
9. Discount Rate	✓	×	×	×	✓	*p*	×	×	×	✓	×	×	×	×
10. Choice of Health Outcomes	✓	×	×	*n/a*	✓	×	*n/a*	✓	×	✓	×	*n/a*	×	✓
11. Measurement of effectiveness	✓	✓	✓	*n/a*	✓	✓	*n/a*	*p*	✓	✓	✓	*n/a*	✓	✓
12. Measurement & Valuation of Preference Based Outcomes (if	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	✓

CHEERS Checklist Criteria	Adams et al., (2007)	Althaus et al., (2014)	Bracebridge et al., (2012)	Cassell et al., (2015)	Hislop et al., (2010)	Jackson et al., (2015)	Kelly et al., (2014)	Looker et al., (2015)	Low et al., (2006)	Low et al., (2007)	Roberts et al., (2012)	Robinson et al., (2007)	Turner et al., (2011)	Turner et al., (2014)
applicable)														
13. Estimating resources and costs	✓	✓	✓	✓	✓	*p*	✓	*p*	✓	✓	✓	✓	✓	*p*
14a. Currency	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14b. Price Date	✓	*p*	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	×
14c. Conversion	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
15. Choice of Model	✓	*p*	×	*n/a*	✓	*n/a*	*n/a*	✓	×	✓	*n/a*	*n/a*	✓	✓
16. Assumptions	✓	✓	✓	✓	✓	✓	×	✓	×	✓	×	×	✓	✓
17. Analytic Methods	✓	✓	×	*n/a*	✓	✓	*n/a*	✓	×	✓	✓	*n/a*	✓	✓
Results														
18. Study Parameters	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19. Incremental costs and outcomes	✓	×	✓	*n/a*	✓	*n/a*	*n/a*	✓	✓	✓	✓	*n/a*	✓	✓
20. Characterising uncertainty	✓	✓	×	*n/a*	✓	✓	×	✓	×	✓	✓	✓	✓	✓
21. Characterising heterogeneity (if applicable)	✓	*n/a*	*p*	*n/a*	✓	*n/a*	✓	*n/a*	*n/a*	✓	✓	*n/a*	✓	*n/a*
Discussion														
22. Discussion - Study findings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
23. Discussion - Limitations	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
24. Discussion - Generalisability	*p*	✓	*p*	×	×	✓	*p*	✓	*p*	×	✓	✓	✓	✓

CHEERS Checklist Criteria	Adams et al., (2007)	Althaus et al., (2014)	Bracebridge et al., (2012)	Cassell et al., (2015)	Hislop et al., (2010)	Jackson et al., (2015)	Kelly et al., (2014)	Looker et al., (2015)	Low et al., (2006)	Low et al., (2007)	Roberts et al., (2012)	Robinson et al., (2007)	Turner et al., (2011)	Turner et al., (2014)
25. Discussion - Current Knowledge	✓	✓	*p*	×	×	✓	*p*	✓	*p*	×	✓	✓	✓	✓
Other														
26. Source of funding	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
27. Conflicts of interest	✓	✓	✓	×	×	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 7.9 - Summary of Quality Assessment Against CHEERS Checklist

Key: ✓ = Met, *p* = partially met, × = no evidence reported, *n/a* = not applicable.

The following sub-sections present the high-level findings of the assessment of studies against the relevant sections of the CHEERS checklist.

7.3.5.1 Reporting of Title, Abstract & Introduction

Of the three studies whose titles did not identify them as a costing study or economic evaluation (Bracebridge et al., 2012, Kelly et al., 2014, Low et al., 2006) the economic analysis was reported alongside a clinical or service evaluation. Similarly, where abstracts partially met the checklist requirements, the economic analysis/ costing study was reported as part of an HTA, or as part of another evaluation. The exception to this was the study published by Looker and colleagues (2015) whose article focused on the mathematical modelling component of the economic evaluation rather than the evaluation. In this study the reporting focused on the construction of the model rather than the economic evaluation.

7.3.5.2 Reporting of Methods

Key elements from the methods section of the checklist are summarised in table 7.10 at the end of this section. Almost all studies were clear on their target population and subgroups for the setting of the study. In respect of the study perspective for the analysis, four of the fourteen were not clear (Bracebridge et al., 2012, Kelly et al., 2014, Looker et al., 2015, and Low et al., 2007) and a further seven indicated the perspective of the health service or NHS but did not state whether this was the commissioner or provider perspective (Adams et al., 2007, Althaus et al., 2014, Cassell et al., 2015, Jackson et al., 2015, Low et al., 2006 Roberts et al., 2012 and Robinson et al., 2007).

In the majority of cases it was possible to deduce whether a healthcare commissioner or provider perspective has been taken from the reporting of resources and costs. For example, "the cost agreed with the provider per posted kit was £12" (Bracebridge et al., 2012:377) suggests a healthcare commissioner perspective, along with "an analysis of the cost of providing the service in primary care included the LES tariff" (Kelly et al., 2014:752), whereas statements such as "we obtained the hourly rates of pay (including employer contributions)" (Low et al., 2006:2) and "we measured the time taken to complete each labour dependent step for the diagnostic tests" (Robinson et al., 2007:277) suggest a provider perspective. As highlighted by the NICE costing impact guidance (NICE, 2011a) and Mogyorosy and Smith (2005), this distinction is important. They note that "there could be a difference in the unit cost depending on whether the cost to provide activity or to commission activity is used" (NICE 2011a:2.6) and suggests that where both are available the cost to commission activity should be used for costing (ibid.).

With the exception of Robinson and colleagues which was a costing study of a single intervention, all other studies stated the comparators which are summarised in table 7.10. These include:

- Theoretical modelling scenarios based on variance of parameters (Adams et al., 2014, Althaus et al., 2014, Cassell et al., 2015, Looker et al., 2015, Low et al., 2007 and Turner et al., 2011),
- Tangible service delivery, i.e. actual pathways (Bracebridge et al., 2012, Hislop et al., 2010, Jackson et al., 2015, Kelly et al., 2014, Low et al., 2006, Roberts et al., 2012, and Turner et al., 2014).

The majority of studies (nine) did not identify a time horizon, with evaluation dealing purely with the immediate costs and outcomes associated with the delivery of the service. Of those which did (Adams et al., 2007, Looker et al., 2015 and Low et al., 2007) were studies that included health outcomes beyond immediate treatment and partner notification. These also applied a discount rate because the time horizon extended beyond a one-year period. Two other studies included a stated time horizon (Hislop et al., 2010 and Turner et al., 2014); however, these were short term time horizons of under a month.

All of the cost-effectiveness studies included measures of effectiveness. Examples include:

- Screening Uptake (Althaus et al., 2014, Bracebridge et al., 2012, Jackson et al., 2015),
- Test Accuracy Parameters (Hislop et al., 2010),
- Positivity Rates/ Cases Detected (Bracebridge et al., 2012, Hislop et al., 2010, Kelly et al., 2014),
- Treatment Uptake (Bracebridge et al., 2012, Hislop et al., 2010),
- Partner Notification Efficacy (Althaus et al., 2014, Low et al., 2006, Roberts et al., 2012).

Four studies included health outcomes, three included QALYs (Adams et al., 2007, Looker et al., 2015 and Turner et al., 2014). Two included major outcomes averted (Adams et al., 2007, Low et al., 2007), and one of these included both QALYs and MOA (Adams et al., 2007). Twelve of the studies included measures of effectiveness, whilst those which do not were costing studies.

All studies included information to varying degrees on the estimation of resources and costs. The costing data sources cited are summarised in table 7.10. It is important to note that there is some recycling of cost data between studies, in particular the ClaSS study data (Low et al., 2007) is used by Cassell et al., 2015 and Roberts et al., 2012, and the APT trial data (Roberts et al., 2012) is used by Cassell et al., 2015. For studies costing elements of NCSP pathways, the 2008-09 costing exercise run by the NCSP was used to inform costs (Althaus et al., 2014, Bracebridge et al., 2012 and Turner et al., 2011). Seven of the studies included an element of primary costing work (Bracebridge et al., 2012, Jackson et al., 2015, Kelly et al., 2014, Roberts et al., 2012, Robinson et al., 2007, Turner et al., 2011 and Turner et al., 2014). These cover the range of costing precision from highly detailed time and motion studies (Robinson et al., 2007) and a pilot RCT (Roberts et al., 2012), pathway mapping (Turner et al., 2014) and semi-structured interviews (Turner et al., 2011), to costing alongside service evaluations at a higher level (Bracebridge et al., 2012 and Kelly et al., 2014).

The review of costing data sources in the published studies was also helpful in identifying data sources which can be used in costing the comparator pathways. These include:

- Payment by Results National Tariff (Althaus et al., 2014),
- GP and Pharmacy LES payments (Althaus et al., 2014),
- NCSP Costing initiative 2008-09 (Althaus et al., 2014, Bracebridge et al., 2012, Turner et al., 2011),
- Test manufacturer's data (Hislop et al., 2010),
- Healthcare Resource Groups (HRGs) Reference Costs (Low et al., 2007),
- Personal Social Services Research Unit (PSSRU) (Low et al., 2007).

The majority of studies (eleven of fourteen) indicated the year the costs included in the analysis related to (Althaus et al., 2014, Looker et al., 2015, and Turner et al., 2014 do not), and all stated the currency as British Pounds. The date range for the literature review was studies published between 2005 and 2015, and the range of years that the analysis related to is from 2003 to 2012-13.

The seven cost-effectiveness analysis studies all contained details of an economic model (Adams et al., 2007, Althaus et al., 2014, Hislop et al., 2010, Looker et al., 2015, Low et al., 2007, Turner et al., 2011 and Turner et al., 2014). All cost-effectiveness studies provided tables detailing the model parameters. Where details of an economic model have been provided, three are dynamic (Adams et al., 2007, Looker et al., 2015 and Low et al., 2007), and four are static (Althaus et al., 2014, Hislop et al., 2010, Turner et al., 2011 and Turner et al., 2014). The majority of studies contained detail of the assumptions made in the economic models or costing; however, the quality of the way in which these are reported is variable with examples of assumptions interspersed throughout the text to assumptions clearly summarised in tables.

Ref	Author	Perspective	Comparators	Costing Data Source	Price Date	Model Type
1.	Adams et al. (2007)	NHS in England	Different screening strategies compared to no screening	Standard data sources Other published studies	2004	Stochastic individual based, dynamic sexual network model
2.	Althaus et al. (2014)	Healthcare Provider	Scenario analysis to investigate the effects of partner notification efficacy, partner positivity and screening coverage on the cost per positive of screening	NCSP costing initiative 2008-09 Proportion of GUM tariff GP & Pharmacy LES payments	2010-11	Static model
3.	Bracebridge et al. (2012)	Not stated, presentation of costs suggests healthcare commissioner	Costs of postal service compared with costs of NCSP in 2008-09.	Primary Costing Study NCSP costing initiative 2008-09	2008	Not Applicable
4.	Cassell et al. (2015)	NHS in England	The costs associated with the pilot PN pathways with two separate studies comparing the costs (and outcomes) associated with PN strategies with current practice in the UK	Other published studies (ref 10 &11)	2011	Not Applicable
5.	Hislop et al. (2010)	Healthcare Provider (Family Planning Clinic)	Clearview POCT, CRT POCT and current practice (PCR)	Test manufacturers Other published studies Expert opinion	Not stated	Decision analytic model
6.	Jackson et al. (2015)	Health Service	Captain led and poster STI screening Sexual health advisor and poster STI screening Poster only STI screening promotion (control group)	Primary Costing Study	2012-13	Not Applicable
7.	Kelly et al. (2014)	Not stated, presentation of costs suggests healthcare commissioner	Primary care pilot and secondary care service	Primary Costing Study Assumptions on existing expenditure	2012	Not Applicable

Ref	Author	Perspective	Comparators	Costing Data Source	Price Date	Model Type
8.	Looker et al. 2015)	Not stated, presentation of costs suggests NHS	Screening with no testing	Parameters used stated but not source	Not Stated	Deterministic compartmental dynamic model
9.	Low et al. (2006)	Health Service	Partner notification by practice nurses compared with partner notification by GUM clinic	Other published studies	2003	Not Applicable
10.	Low et al. (2007)	Not stated, presentation of costs suggests healthcare commissioner	Screening women v's no screening Screening men and women v's no screening Screening men and women v's screening women only	Other published studies (ClaSS) HRGs PSSRU Other published studies	2003	Discrete event simulation
11.	Roberts et al. (2012)	NHS	APT Hotline, APT pharmacy and routine PN	Other published study (ref 10) Primary Costing Study	2008	Not applicable
12.	Robinson et al. (2007)	Health service and private costs of patients	Not applicable – costing study investigated the average cost the health service of a single round of proactive screening for chlamydia	Primary Costing Study	2005	Not applicable
13.	Turner et al. (2011)	Healthcare provider perspective	Comparison of current baseline with increased coverage of screening in men and increased efficacy of partner notification	NCSP Costing Initiative (2008-09) Available data sources Semi-structured interviews	2008-09	Static model
14.	Turner et al. (2014)	Healthcare provider perspective (GUM clinic)	Current practice in GUM clinics compared with POCT in GUM clinics	Primary Costing Study Other published studies	Not Stated	Decision analytic model

Table 7.10 - Summary of Key Elements of Study Methods

7.3.5.3 Reporting of Results

All 14 studies contained a summary of the results identified, although the level of detail varied between studies. For example, the standalone economic evaluations contained more detail than the integrated studies where weight also had to be given to reporting the clinical findings. Only two (29%) of the seven cost-effectiveness analysis studies (Adams et al., 2007 and Low et al., 2007) included an incremental cost-effectiveness ratio (ICER). A summary of the outcomes reported is included in table 7.11. Nine (64%) of the 14 studies explored uncertainty of model input parameters and/ or assumptions relating to costing using techniques including:

- Probabilistic multivariate sensitivity analysis (Adams et al., 2007),
- Scenario analysis (Althaus et al., 2014, Turner et al., 2014),
- One way sensitivity analysis (Hislop et al., 2010, Jackson et al., 2015),
- Sensitivity analysis – no further detail on type provided (Looker et al., 2015, Low et al., 2007, Robinson et al., 2007, Turner et al., 2011).

One study (Roberts et al., 2012) reported that it was not appropriate to undertake sensitivity analysis because "the results are illustrative, preliminary and subject to bias" (Roberts et al., 2012:19).

Ref	Author	Outcomes Included
1.	Adams et al., (2007)	PID Ectopic Pregnancy Tubal Factor Infertility Neonatal Conjunctivitis Neonatal Pneumonia
2.	Althaus et al., (2014)	Cost per positive of screening
3.	Bracebridge et al., (2012)	Screening uptake Test positivity rate
4.	Cassell et al., (2015)	N/A – Cost Analysis
5.	Hislop et al., (2010)	Number of false-positives Number of false-negatives Number of false-positives treated Number of true-positives Number of true-negatives Number of true-positives treated Number of partners reported for true-positives Number of partners reported for false-positives Total costs of offering, screening and treating index patients and their partners Effectiveness measured as true positive cases identified and treated and their partners notified Effectiveness measured as number of cases correctly identified and treated if necessary and partners of positive cases identified
6.	Jackson et al., (2015)	Offer of Screening Accepted
7.	Kelly et al., (2014)	Chlamydia positivity rate
8.	Looker et al., (2015)	PID Tubal Factor Infertility
9.	Low et al., (2006)	Proportion of index cases with at one treated sexual partner Number of sexual contacts elicited during a sexual history Positive test result for chlamydia six weeks after treatment
10.	Low et al., (2007)	PID Infertility Ectopic pregnancy Neonatal Complications
11.	Roberts et al., (2012)	Number and proportion of partners treated
12.	Robinson et al., (2007)	N/A – Cost Analysis
13.	Turner et al., (2011)	Cost per individual tested Cost per positive diagnosis Total cost of screening Number screened Number infected Sex ratio of those tested and treated

Ref	Author	Outcomes Included
14.	Turner et al., (2014)	Cost per QALY gained Number of overtreatments prevented Onward transmissions prevented PID cases prevented

Table 7.11 - Summary of Outcomes Included

7.3.5.4 Reporting of Discussion

All of the included studies discussed the study findings and all except two discussed the limitations of the costing study/ economic evaluation. The two which did not were studies where the economic evaluation was a component of a broader service evaluation (Bracebridge et al., 2012, Kelly et al., 2014). Reporting of generalisability of findings and current knowledge, was generally reported more comprehensively in the standalone economic evaluation papers than the papers reporting economic analysis alongside clinical evaluation, with the latter situating these discussions in the clinical rather than economic context.

7.3.5.5 Reporting of Other Checklist Criteria

Finally, all studies with the exception of Bracebridge and colleagues (2012) cited the funding source, and all with the exception of two (Cassell et al., 2015 and Hislop et al., 2010) listed conflicts of interest or declared none.

7.3.6 Discussion

The objective of the literature review was to identify published studies exploring the costs and cost-effectiveness of chlamydia testing and treatment in the UK for the purposes of the identification of resource items, unit of measure and costs. The review identified only one study (Turner et al., 2014) containing recently mapped GUM clinic pathways in London and the South West with sufficient detail published on the pathway mapping separately (Adams et al., 2014) to be used in this study.

A refresh of the literature search was undertaken to identify new studies published up to December 2016 and identified no further studies for inclusion. From an NCSP pathway perspective it was noted that all studies using NCSP pathways are based on the 2008-09 costing initiative. There have been two major structural changes within the NHS since this was undertaken, which may have an impact on resource use and costs – the dissolution of PCT provider arms, the primary body coordinating and delivering the NCSP in 2010, and the transfer of responsibility for public health commissioning to LAs in 2013, which has led to a number of services being competitively tendered and subsequent changes to pathways. Alongside this, there has been a shift in patterns of access to chlamydia testing and treatment with an increase in internet testing from less than 1% in 2006 to 6% in 2010, with a range across geographical areas of less than 1% to 38% of tests accessed online (Woodhall et al., 2012).

Considering the stages of economic evaluation within HTA outlined by Sculpher and colleagues (1997) the articles included can be categorised as follows:

Stage of Economic Evaluation	Included Studies
i. Early Developmental	Althaus et al., (2014) Cassell et al., (2015)
ii. Maturing Innovation	Bracebridge et al., (2012) Jackson et al., (2015) Kelly et al., (2014) Roberts et al., (2012) Turner et al., (2014)
iii. Close to Wide Spread Diffusion	Hislop et al., (2010) Low et al., (2006) Robinson et al., (2007)
iv. Moving into Practice	Adams et al., (2007) Looker et al., (2015) Low et al., (2007) Turner et al., (2011)

Table 7.12 - Included studies categorised by stage of economic evaluation in HTA

The majority of studies fall into two category groups – maturing innovation and moving into practice. The 'moving into practice' category represent the modelling studies where data are used to generalise results to other settings or extrapolate to a longer term view of the impact of the interventions. In all cases these studies relate to the consideration of chlamydia screening programmes in their entirety and their impact depends on variance in a number of parameters, for example, population screened. The 'maturing innovation' category identifies studies which explore pathways or technologies that are at a much earlier stage of development. These fall into two categories – studies exploring the delivery of a service through an alternative pathway using existing technology (Bracebridge et al., 2012, Jackson et al., 2012 and Kelly et al., 2014), and studies exploring the delivery of a service through the introduction of a new technology – accelerated partner therapy (Roberts et al., 2012), and rapid POCT (Turner et al., 2014).

The categorisation of economic evaluations is based on comparisons against Sculpher and colleagues view of the stages of economic evaluation in HTA (Sculpher et al., 1997). If the stages of product development (Ijzerman and Steuten, 2011) were applied to the studies included in this literature review it would suggest that the economic evaluations selected are not always appropriate for the stage of product development.

For example, Turner and colleagues' cost-effectiveness analysis of rapid POCT in a GUM clinic setting is an evaluation of a new technology in so far as it is not adopted yet within mainstream clinical services in England. However, the technology itself is fully developed with FDA approval. Therefore, Ijzerman and Steuten's approach would class this as stage 4 product development – access and pricing, whereas the economic evaluation taxonomy suggests the evaluation of a technology at stage 2, translational research.

None of the published studies consider the implementation an online clinical care pathway similar to OCCP, although two explore remote pathways. Bracebridge and colleagues study explore an internet, postal and telephone based approach to delivering chlamydia testing and treatment (Bracebridge et al., 2012), whilst Roberts and colleagues explore the use of a telephone hotline for the delivery of accelerated partner therapy for partners of patients diagnosed with chlamydia or gonorrhoea (Roberts et al., 2012).

Considering the delivery model for the NCSP internet testing pathway, none of the papers included which examined a full screening pathway costed a pathway which is currently reflective of how the NCSP is delivered (a comparator pathway in the OCCP exploratory study). This is a reflection of the evolution of sexual health services outlined in section 2.4 and identifies a gap in the published literature considering the costs and cost-effectiveness of delivering chlamydia screening.

7.3.7 Summary and Conclusions

Fourteen studies were identified for inclusion in this literature review exploring aspects of the chlamydia testing and treatment pathway ranging from highly theoretical modelling to determine cost-effectiveness to pragmatic service evaluations and early stage testing of new models of care and technology to consider preliminary cost-effectiveness and issues for future studies.

The absence of published studies exploring the cost-effectiveness of eHealth solutions for chlamydia treatment and partner notification demonstrates that the costing study and outcomes data outlined in the following sections will add new knowledge in terms of a preliminary view on whether the OCCP is cost saving.

7.4 Literature Review – Consequences

Table 7.4 contains the outcome measures identified for the OCCP exploratory study. The objective of this literature review was to identify published studies which provide comparative outcomes data for the GUM and NCSP internet testing pathways.

The inclusion criteria for the literature review were identified as:

- any published study containing chlamydia trachomatis outcomes data for GUM or NCSP internet testing services
- studies published between 2005 and September 2016. As with the literature review which identified economic analyses, this date range was selected to reflect the significant changes in the delivery of sexual health services in England, summarised in section 2.4.

The exclusion criteria were identified as studies:

- not related to humans
- not published in English
- from outside of the UK
- that do not provide outcomes data which are directly comparable with the primary and secondary outcomes of the OCCP.

7.4.1 Search Strategy

The following databases were searched on 23 September 2016:

- Medline
- EMBASE
- Cochrane Library (incorporating the following databases):
    - Cochrane Database of Systematic Reviews
    - Cochrane Central Register of Controlled Trials
    - Cochrane Methodology Register
    - Database of Abstracts of Reviews of Effects

- Health Technology Assessment Database
- NHS Economic Evaluation Database.

The key search terms and their abbreviated database entry (where applicable, abbreviation example from Medline) are summarised in table 7.13, the full Medline search is included in Appendix 17. Search terms were identified from the definitions of the OCCP exploratory study outcomes. Searches were structured in the databases to meet the search requirements of the respective database and terms exploded where the facility existed to do this. Exploded search terms included 'time to treatment', 'treatment outcome' and 'contact tracing'. This extended the search terms covered to include, for example: clinical effectiveness, clinical efficacy, treatment effectiveness, treatment efficacy, patient relevant outcome, partner notification and communicable disease/ infectious disease contact tracing.

Category	Search Terms Entered
Chlamydia	Chlamydia Chlamydia Trachomatis Genital
	AND
Outcomes	time-to-treatment loss to follow* appropriate clinical management treatment outcome diagnosis to treatment contact tracing

Table 7.13 - Search Terms taken from the Medline Search

The results were imported into Endnote x7 for Mac and duplicates removed. The titles and abstracts were reviewed and studies excluded for the following reasons:

- Study did not include genital *Chlamydia Trachomatis*
- Study did not include outcomes which are comparable with OCCP outcomes
- Study not conducted in the UK

- Not primary research or systematic review e.g. study protocol.

In addition to the database searches for published studies, the literature review was extended to include known primary data sources. PHE is the agency responsible for the collection of data on STIs and sexual health services in England (and holds the data previously published by the NCSP). A review of the studies included in the literature review also identified the BASHH clinical audit group as a further source of primary data on chlamydia testing and treatment.

7.4.2 Search Results

The initial search identified 372 records and 41 duplicates were removed in Endnote leaving 331 for initial review. The titles and abstracts were reviewed for each exclusion criterion in turn; leaving a total of 16 studies that met the inclusion criteria for full review.

The search results are illustrated in the PRISMA flowchart, figure 7.4:

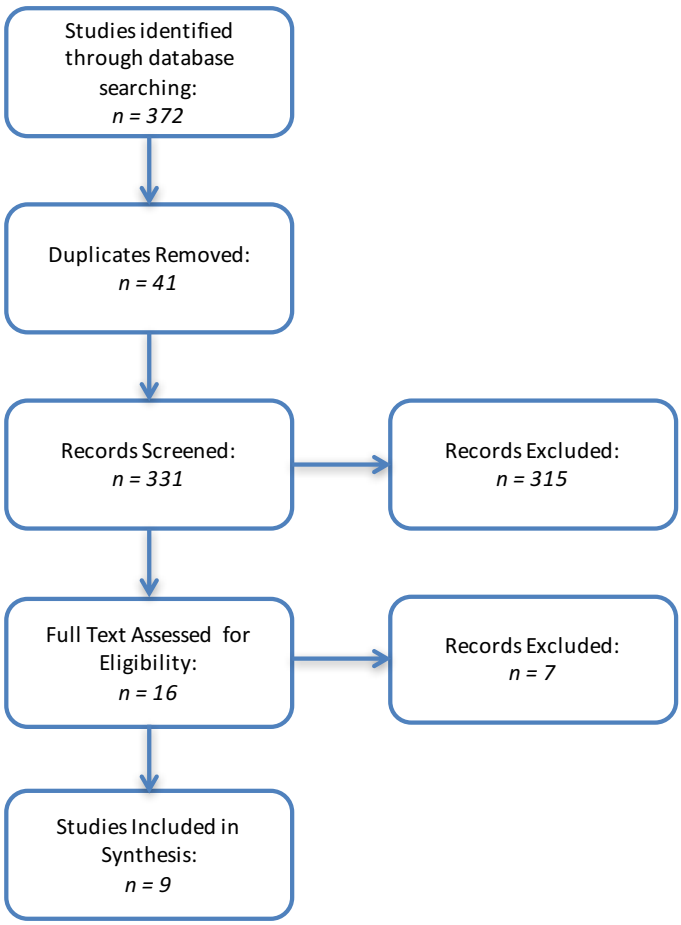

Figure 7.4 - PRISMA Flowchart of Included Studies

The reasons for the exclusion of studies at the screening stage are summarised in table 7.14:

Reasons for Exclusion at Screening Stage	Number of Studies Excluded
Study not genital Chlamydia	159
Does not include OCCP Outcomes	111
Study not in the UK	37
Not a study/ systematic review e.g. abstract only, study protocol	8

Table 7.14 - Reasons for Exclusion of Papers at Screening Stage

A further seven studies were excluded at the full text review:

Reasons for Exclusion at Full Text Review	Number of Studies Excluded
Full text review identified that study did not include OCCP outcomes	5
The data source for the outcome included in the study is an assumption	2

Table 7.15 - Studies excluded after full text review

7.4.3 Data Extraction

The data extraction form was designed to capture the key data on the setting, study type and outcomes data. Data were extracted into an electronic template prepared in Excel for Mac 2010.

7.4.4 Key Findings

Nine studies were identified containing comparable outcomes data to the OCCP primary and secondary outcomes. Four were service evaluations (Brook et al., 2011, Fernando & Clutterbuck, 2005, Forbes & Clutterbuck, 2009 and Raval & Challenor, 2006), two were RCTs - one a pilot (Estcourt et al., 2015) and one a full RCT (Low et al., 2007), and three were clinical audits (Challenor et al., 2005, McClean et al., 2006 and McClean et al., 2008). Seven were conducted in a GUM/ sexual health clinic setting (Brook et al., 2011, Challenor et al., 2005, Fernando & Clutterbuck, 2005, Forbes & Clutterbuck, 2009, McClean et al., 2006, McClean et al., 2008 and Raval & Challenor, 2006) and two were conducted in a primary care setting – one general practice (Low et al., 2007) and one community pharmacy (Estcourt et al., 2015).

Reviewing the PHE and BASHH websites identified three audits containing comparable outcomes: partner notification in chlamydia screening (PHE, 2016), audit report on turnaround times (PHE, 2014) and the UK National Audit of Chlamydial Infection Management (BASHH, 2007). A summary of the available outcomes data for comparator pathways is provided in table 7.16 (GUM) and table 7.17 (NCSP).

Study/ Data Source	Study Type	Year of Study	Sample Size	Outcome	Range	Notes
Proportion of Index Patients Receiving Appropriate Clinical Management						
Brook et al. (2011)	Service Evaluation	2009/10	466	95%	92-98%	Monthly results reported for six months
Challenor et al. (2005)	Clinical Audit	2004	1,670	72%	70.1-74.7%	Percentage of index treated within 4 weeks – England
Fernando and Clutterbuck (2005)	Service Evaluation	2003	83	97.6%		Single result reported
BASHH (2007)	Clinical Audit	2007	5,032	99%	97-100%	Regional Range for uncomplicated infection
Time from Index Patient Receiving Diagnosis to Receiving Appropriate Treatment						
None Identified						
Proportion of Sex Partners Treated (Ratio of Partners Treated per Index)						
Challenor et al. (2005)	Clinical Audit	2004	1,670	0.56	0.54-0.59	Proportion of sex partners treated within 4 weeks of initial PN interview – England. Range is 95% CI
McClean et al. (2006)	Clinical Audit	2001	661	0.62	0.46-0.78	Ratio of contacts seen to index
Raval and Challenor (2006)	Clinical Audit	2004/05	200	0.5 0.7		2004 Outcomes Data 2005 Outcomes Data Proportion of sex partners treated within 4 weeks of initial PN interview. Single result reported
Percentage of Sex Partners Identified by Index Patients Treated						
Challenor et al. (2005)	Clinical Audit	2004	1,670	55%		Percentage of partners seen (UK value)
Fernando & Clutterbuck (2005)	Service Evaluation	2003	83	90%		Single result reported
Low et al. (2007)	RCT	2001-02	64	46.9%		% Partners treated, outcome from GUM arm
McClean et al. (2006)	Clinical Audit	2001	661	55%	42-69%	Percentage of partners seen, range is range of clinic performance
Time from Index Patient Receiving Diagnosis to Partner Receiving Treatment						
None Identified						

Table 7.16 - Summary of Outcomes Data - GUM

Study/ Data Source	Study Type	Year of Study	Sample Size	Outcome	Range	Notes
Proportion of Index Patients Receiving Appropriate Clinical Management						
NCSP (2012b)	National Dataset	2011	83,469	91.6%	56.2-100%	Index treatment rate. Range is the range of individual PCT performance
Public Health England (2014a)	Clinical Audit	2013	3,909	93.45%		Percentage of chlamydia positive patients in audit receiving treatment.
Saunders (2016)	Clinical Audit	2013	397	88.9%		Personal communication detailing subset of PHE clinical audit (2014a) for NCSP internet testing specifically
Time from Index Patient Receiving Diagnosis to Receiving Appropriate Treatment						
Public Health England (2014a)	Clinical Audit	2013	3,619	10.3% 2.2% 2.7% 5.4% 9.9% 58% 11.5%		Same day treatment Within two days Within three days Within four days Within five days Within 6-15 days Greater than 15 Days
Proportion of Sex Partners Treated (Ratio of Partners Treated per Index)						
NCSP (2012b)	National Dataset	2011	83,469	0.5	0.0-1.3	Partner treatment rate. Range is the range of individual PCT performance.
Public Health England (2016a)	Clinical Audit	2015	2,439	0.53		Partner treatment rate.
Percentage of Sex Partners Identified by Index Patients Treated						
Estcourt et al. (2015b)	Pilot RCT	2011-13	102	46%		Control arm partners treated
Low et al. (2007)	RCT	2001-02	119	45%		% Partners Treated, outcome from practice nurse arm
Public Health England (2016a)	Clinical Audit	2015	2,886	58%		Partners attending a service following notification
Time from Index Patient Receiving Diagnosis to Partner Receiving Treatment						
Estcourt et al. (2015b)	Pilot RCT	2011-13	102	0	0-0	Median time from index diagnosis to partner treatment

Table 7.17 - Summary of Outcomes Identified - NCSP/ Primary Care

7.4.5 Summary

A comprehensive review has been undertaken of published studies, national datasets and clinical audits which has identified a range of process measures/ outcomes which are comparable to the OCCP exploratory study primary and secondary outcomes. It can be seen that there are some significant differences in outcomes, this could be due to sample size, or clinical practice at the time the study was undertaken. It is important to note that the outcomes cover all testing routes within the NCSP e.g. tests originating at GP and CaSH clinics as well as tests ordered online, with the exception of treatment uptake rate. The extent to which this is an issue is unknown, in respect of treatment and partner notification outcomes, the treatment options available to positive patients are the same regardless of the testing route. The national datasets and clinical audits undertaken by PHE and BASHH offer a considerably larger sample size than the published studies.

A second point to note is the year in which the study was undertaken. As highlighted previously and summarised in section 2.4.1, there were significant changes to STI service delivery models which may have impacted directly on the outcomes through the introduction of the 48-hour GUM access target, and the roll out of the NCSP (HM Government, 2003, HM Government, 2005). Whilst it is recommended that for eHTA published studies are used to inform assessments of the likely cost-effectiveness it is inappropriate to apply these if the outcomes do not reflect outcomes from current service delivery models.

7.5 Costing Study

The following sections outline the primary data collection undertaken to inform the costing of the OCCP and the comparator pathways.

7.5.1 Data Collection – OCCP Exploratory Study

In order to capture the data on the costs associated with the pilot study the following activities were undertaken:

- The eSTI[2] Programme Manager captured all costs incurred by the OCCP exploratory study in respect of non-staff costs which were reported to the researcher. The researcher and programme manager met to clarify reported costs.
- The OCCP exploratory study research health advisors completed a spreadsheet which captured all contacts with the telephone helpline, and all activities undertaken by the health advisors in respect of patients. This included the start and finish time of the contact, and the nature of the contact.
- Pharmacist Interview – there was one pharmacist who dispensed a significant proportion of the azithromycin in the exploratory study. The researcher interviewed him in order to ascertain the resource inputs for dispensing items as part of the proof of concept study.

7.5.2 Data Collection – GUM

As identified in section 7.3.6 one study was identified (Turner et al., 2014) which used recently mapped GUM clinic pathways published separately (Adams et al., 2014). A second GUM clinic pathway was mapped as part of the costing study to provide a comparison. Data were collected through interviews with the service lead, service manager and directorate accountant who provided estimates of the resource use in delivering the elements of the GUM clinic pathway included in the study.

The initial interview took place with the service lead to map the pathway, and subsequent interviews were undertaken with the service manager and service accountant to identify costs associated with resource use identified by the service lead.

7.5.3 Data Collection – NCSP Internet Testing Pathway

Two NCSP internet testing pathways were mapped, one in London, one in the West Midlands (semi-rural location). Data were collected through interviews with a range of staff to provide estimates of the resource use in delivering elements of the NCSP internet testing pathway included in the study. A summary of the interview participants is included in table 7.18. Participants were identified by the commissioner or service lead who undertook the initial interview to map the pathway. A slightly different approach was taken between the two pathways, in pathway one the service lead was interviewed and undertook to provide the missing data by sourcing the information and providing it to the researcher, whereas in the second pathway, the service lead identified the staff that the research should contact and additional interviews with those staff took place. The interview topic guide is included in Appendix 15.

Pathway 1 Interviews	Pathway 2 Interviews
• Service Lead • Chlamydia Screening Office Lead	• Chlamydia Screening Lead • Service Manager • Directorate Accountant

Table 7.18 - NCSP Internet Testing Pathway Interviews

7.5.4 Data Collection – Outcomes

Data on the outcomes of individual patients completing the OCCP pilot extracted as part of the exploratory study were utilised (Estcourt and Gibbs, 2016). Data on the outcomes of comparator pathways were taken from published data sources.

7.6 Results

7.6.1 Costs

The detailed costing of the pathways are included in tables 7.19 to 7.30. The following assumptions should be noted as per the methods outlined in sections 7.2.1.3 to 7.2.1.5:

- Staff costs were taken from PSSRU (PSSRU, 2016). These costs include management, non-staff and estate overheads. It is therefore assumed that all non-specific service equipment required to deliver the service e.g. computers, servers, clinic room equipment etc and service overheads are included in this value
- Training costs for staff specifically involved in delivering the OCCP were included based on the training required to deliver the exploratory study
- Using Tate and colleagues approach, development costs were excluded and web hosting and maintenance were included (Tate et al., 2009). The life expectancy of the OCCP is governed by the clinical pathway and whether there are changes to the clinical pathway which result in the OCCP requiring significant redevelopment to incorporate these. The current clinical guidelines for the management of genital chlamydia were introduced in 2006 (BASHH, 2006), clinical opinion has not identified any likely change in the immediate future therefore no costs were included relating to the life expectancy of the OCCP itself. The costs relating to hosting and maintenance were not annualised because they were annual costs.

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (seconds)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Results	SMS	0.03	Item	1.00	1	0.03		Text sent to all patients to notify results are available	Identified through pilot costing
Results	Website Hosting	0.10	Item	1.00	1	0.10		Patients log in to get result	Cost invoiced to pilot
Results	Health Advisor Helpline	0.01	Second	1.00	120	1.50	AfC6	24 patients accessed the helpline for assistance with obtaining results	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Results	Positive Notification via GUM Clinic A	5.41	Item	1.00	1	5.41			GUM Clinic A Costing
Results	Notification via NCSP A	1.81	Item	1.00	1	1.81			NCSP A Costing
Results	Notification via NCSP B	1.27	Item	1.00	1	1.27			NCSP B Costing
Results	Health Advisor (GUM Clinic Data Entry)	0.01	Second	1.00	600	7.50	AfC6	GUM Clinic Positive Patients Only	Estimate from pilot researcher, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Website Hosting	1.00	Item	1.00	1	1.00		Based on apportionment of pilot costs as per Tate et al., (2009)	Cost invoiced to pilot
Trt	Health Advisor Helpline (Online) - NCSP	0.01	Second	1.00	120	1.50	AfC6	64 NCSP patients completing online called the helpline	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Health Advisor Helpline (Online) - GUM	0.01	Second	1.00	180	2.25	AfC6	25 GUM patients completing online called the helpline	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Health Advisor Helpline (GUM) - NCSP	0.01	Second	1.00	240	3.00	AfC6	45 NCSP patients calling helpline transferred to GUM	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Health Advisor Helpline (GUM) - GUM	0.01	Second	1.00	360	4.50	AfC6	27 GUM patients calling helpline transferred to GUM	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Pharmacist Dispensing	0.02	Second	1.00	450	7.14			Time from Pharmacist Interview. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (seconds)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Trt	Azithromycin	1.81	Drug	1.00	1	1.81		All patients on pathway treated with Azithromycin	http://www.drugtariff.nhsbsa.nhs.uk/#/00280039-DC/DC00279526/Part%20VIIIA%20products%20A Dec 2015
Trt	GUM Clinic Attendance for Treatment (GUM A)	17.30	Item	1.00	1	17.30		Calculation from GUM A	Service lead and Directorate Accountant Interviews
PN	Included in Website Hosting above	-	Item	1.00	1	-		See above	
Follow Up	Health Advisor	0.01	Second	1.00	480	6.00	AfC6	Based on average duration of calls marked as HA follow up	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Set Up	Health Advisor Training	45.00	Hour	1.00	5	1.02	AfC6	Divided by the number of patients entering online pathway to estimate cost per patient	Estimate from pilot researcher, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Set Up	Pharmacist Training	57.13	Hour	1.00	1	0.38		Divided by the number of patients completing online pathway to estimate cost per patient	Estimate from pilot researcher. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15

Table 7.19 - OCCP with GUM A Costs

Assumptions	
89%	% Log in to get result (NCSP Negative)
92%	% Log in to get result (NCSP Positive)
82%	% Log in to get result (GUM Positive)
11%	% Get results from original service (NCSP -ve)
8%	% Get results from original service (NCSP +ve)
18%	% Get results from original service (GUM)
1%	% Accessing helpline for results
66%	% Completing Pathway Online (NCSP)
71%	% Completing Pathway Online (GUM)
34%	% Transferred to GUM (NCSP)
29%	% Transferred to GUM (GUM)
93%	% Completing online calling helpline (NCSP)
30%	% Completing online calling helpline (GUM)
100%	% Transferred to GUM calling helpline (NCSP)
79%	% Transferred to GUM calling helpline (GUM)

Table 7.20 - OCCP with GUM A Assumptions

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (seconds)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Results	SMS	0.03	Item	1.00	1	0.03		Text sent to all patients to notify results are available	Identified through pilot costing
Results	Website Hosting	0.10	Item	1.00	1	0.10		Patients log in to get result	Cost invoiced to pilot
Results	Health Advisor Helpline	0.01	Second	1.00	120	1.50	AfC6	24 patients accessed the helpline for assistance with obtaining results	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Results	Results Notification via GUM Clinic B	13.63	Item	1.00	1	13.63			GUM Clinic B Calculations
Results	Notification via NCSP A	1.81	Item	1.00	1	1.81			NCSP A Costing
Results	Notification via NCSP B	1.27	Item	1.00	1	1.27			NCSP B Costing
Results	Health Advisor (GUM Clinic Data Entry)	0.01	Second	1.00	600	7.50	AfC6	GUM Clinic Positive Patients Only	Estimate from pilot researcher, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Website Hosting	1.00	Item	1.00	1	1.00		Based on apportionment of pilot costs as per Tate et al., (2009)	Cost invoiced to pilot
Trt	Health Advisor Helpline (Online) - NCSP	0.01	Second	1.00	120	1.50	AfC6	64 NCSP patients completing online called the helpline	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Health Advisor Helpline (Online) - GUM	0.01	Second	1.00	180	2.25	AfC6	25 GUM patients completing online called the helpline	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Health Advisor Helpline (GUM) - NCSP	0.01	Second	1.00	240	3.00	AfC6	45 NCSP patients calling helpline transferred to GUM	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Health Advisor Helpline (GUM) - GUM	0.01	Second	1.00	360	4.50	AfC6	27 GUM patients calling helpline transferred to GUM	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Trt	Pharmacist Dispensing	0.02	Second	1.00	450	7.14			Time from Pharmacist Interview. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (seconds)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Trt	Azithromycin	1.81	Drug	1.00	1	1.81		All patients on pathway treated with Azithromycin	http://www.drugtariff.nhsbsa.nhs.uk/#/00280039-DC/DC00279526/Part%20VIIIA%20products%20A Dec 2015
Trt	GUM Clinic Attendance for Treatment	31.47	Item	1.00	1	31.47		Calculation from data (Adams et al., 2014)	Adams et al., (2014) Sup Info
PN	Included in Website Hosting above	-	Item	1.00	1	-		See above	
Follow Up	Health Advisor	0.01	Second	1.00	480	6.00	AfC6	Based on average duration of calls marked as HA follow up	HA Telephone Call Logs, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Set Up	Health Advisor Training	45.00	Hour	1.00	5	1.02	AfC6	Divided by the number of patients entering online pathway to estimate cost per patient	Estimate from pilot researcher, PSSRU Band 6 Hospital Based Nurse Unit Cost 2015
Set Up	Pharmacist Training	57.13	Hour	1.00	1	0.38		Divided by the number of patients completing online pathway to estimate cost per patient	Estimate from pilot researcher. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15

Table 7.21 - OCCP with GUM B Costs

Assumptions	
89%	% Log in to get result (NCSP Negative)
92%	% Log in to get result (NCSP Positive)
82%	% Log in to get result (GUM Positive)
11%	% Get results from original service (NCSP -ve)
8%	% Get results from original service (NCSP +ve)
18%	% Get results from original service (GUM)
1%	% Accessing helpline for results
66%	% Completing Pathway Online (NCSP)
71%	% Completing Pathway Online (GUM)
34%	% Transferred to GUM (NCSP)
29%	% Transferred to GUM (GUM)
93%	% Completing online calling helpline (NCSP)
30%	% Completing online calling helpline (GUM)
100%	% Transferred to GUM calling helpline (NCSP)
79%	% Transferred to GUM calling helpline (GUM)

Table 7.22 - OCCP with GUM B Assumptions

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (Mins)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Res -ve	SMS	0.05	Item	1.00	1	0.05		Negative Result	Interview with Service Lead
Res -ve	HCSW Time Results System (AfC3)	0.42	Minute	1.00	5	2.08	AfC3	Negative Result	PSSRU 2015 cost for Band 3 Hospital based nurse
Res +ve	SMS	0.05	Item	1.00	1	0.05	AfC6	Positive Result	Interview with Service Lead
Res +ve	Nurse Time SMS (AfC7)	0.90	Minute	1.00	3	2.70	AfC7	Positive Result	Interview with Service Lead. PSSRU cost for band 7 hospital based nurse 2015
Res +ve	Phone Call - Admin Time (AfC2)	-	Item	1.00	2	-		Positive Result	Admin time incorporated in PSSRU estimate for nursing staff
Res +ve	Nurse Time (AfC 7) Phone Call	0.90	Minute	0.98	3	2.65	AfC7	Positive Result	Interview with Service Lead. PSSRU cost for band 7 hospital based nurse 2015
Res +ve	Letter Notification	0.65	Item	0.02	1	0.01		Positive Result. Cost of 2nd class post and preparation of standard letter	Interview with Service Lead
Trt	Admin Time (AfC 2)	0.38	Minute	1.00	2	0.77	AfC2		Interview with Service Lead. PSSRU cost for band 2 hospital based nurse 2015
Trt	Nurse Time (AfC 7)	0.90	Minute	1.00	15	13.50	AfC7		Interview with Service Lead. PSSRU cost for band 7 hospital based nurse 2015
Trt	Azithromycin	2.22	Item	1.00	1	2.22			Interview with Directorate Accountant
Trt	STI Literature	0.06	Item	3.00	1	0.19		Costs not identifiable from budget	Adams et al., (2014), Supp info, uplifted using HCHS inflation to 2014/15
Trt	Male Condom	0.06	Item	10.00	1	0.62		Costs not identifiable from budget	Adams et al., (2014), Supp info, uplifted using HCHS inflation to 2014/15
PN	PN Slip	0.05	Item	3.00	1	0.16		Costs not identifiable from budget	Adams et al., (2014), Supp info, uplifted using HCHS inflation to 2014/15
Sup PN	Nurse Time (AfC 7)	0.90	Minute	1.00	10	9.00		Based on 10 mins time per patient	Interview with Service Lead. PSSRU cost for band 7 hospital based nurse 2015

Table 7.23 - GUM A Costs

Assumptions	
92%	% Negative Result
8%	% Positive Result
5%	% Requesting supported PN

Table 7.24 - GUM A Assumptions

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (Mins)	Total Cost per Patient (£)	Total Cost per Patient Uplifted to 2014/15 Prices (£)	Staff Grade	Notes	Source	Cost based on PSSRU 2015	Total Cost per Patient (£)
Res -ve	Nurse	0.75	Minute	1.00	6	4.50	4.67	AfC 5/6	Negative Result	Adams et al., (2014), Supp info	0.68	4.05
Res -ve	Letter Notification	0.58	Item	0.02	1	0.01	0.01		Negative Result	Adams et al., (2014), Supp info	0.58	0.01
Res -ve	Phone Call	0.07	Minute	0.03	1	0.00	0.00		Negative Result	Adams et al., (2014), Supp info	0.07	0.00
Res -ve	SMS	0.10	Item	0.95	1	0.10	0.10		Negative Result	Adams et al., (2014), Supp info	0.10	0.10
Res +ve	Nurse	1.10	Minute	0.50	15	8.25	8.56	AfC 7/8	Positive Result	Adams et al., (2014), Supp info	0.98	7.31
Res +ve	Health Advisor	1.03	Minute	0.50	15	7.73	8.01	Not Stated	Positive Result	Adams et al., (2014), Supp info	0.83	6.19
Res +ve	Letter Notification	0.58	Item	0.05	1	0.03	0.03		Positive Result	Adams et al., (2014), Supp info	0.07	0.03
Res +ve	Phone Call	0.07	Minute	0.05	1	0.00	0.00		Positive Result	Adams et al., (2014), Supp info	0.10	0.00
Res +ve	SMS	0.10	Item	0.90	1	0.09	0.09		Positive Result	Adams et al., (2014), Supp info	0.53	0.09
Trt	Admin/ Clerical	0.53	Minute	1.00	5	2.65	2.75	Not Stated		Adams et al., (2014), Supp info	0.42	2.08

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (Mins)	Total Cost per Patient (£)	Total Cost per Patient Uplifted to 2014/15 Prices (£)	Staff Grade	Notes	Source	Cost based on PSSRU 2015	Total Cost per Patient (£)
Trt	Doctor/ Nurse - Results	1.45	Minute	1.00	5	7.25	7.52	Doctor/ AfC 7/8		Adams et al., (2014), Supp info	1.29	6.44
Trt	Doctor/ Nurse - Treatment	1.45	Minute	1.00	6	8.70	9.03	Doctor/ AfC 7/8		Adams et al., (2014), Supp info	1.29	7.73
Trt	KY Lubricant	0.30	Application	2.00	1	0.60	0.62			Adams et al., (2014), Supp info	0.30	0.62
Trt	STI Literature	0.06	Item	3.00	1	0.18	0.19			Adams et al., (2014), Supp info	0.06	0.19
Trt	Male Condom	0.06	Item	10.00	1	0.60	0.62			Adams et al., (2014), Supp info	0.06	0.62
Trt	Azithromycin	4.50	Trt Course	0.95	1	4.28	4.44			Adams et al., (2014), Supp info	4.50	4.44
Trt	Doxycycline	2.03	Trt Course	0.05	1	0.10	0.11			Adams et al., (2014), Supp info	2.03	0.11
PN	Doctor/ Nurse - PN	1.45	Minute	1.00	6	8.70	9.03	Doctor/ AfC 7/8		Adams et al., (2014), Supp info	1.29	7.73
PN	PN Slip	0.05	Item	3.00	1	0.15	0.16			Adams et al., (2014), Supp info	0.05	0.16
Sup PN	Health Advisor (Blend)	1.03	Minute	1.00	15	15.45	16.03	Not Stated		Adams et al., (2014), Supp info	0.83	12.38
Sup PN	Phone Call	0.07	Minute	15.00	1	1.05	1.09			Adams et al., (2014), Supp info	0.07	1.09

Table 7.25 - GUM B Costs

Assumptions	
100%	% Negative Result
1%	% Positive Result
10%	% Requesting supported PN

Table 7.26 - GUM B Assumptions

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (Mins)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Results	Central Results Admin	0.42	Minute	1.00	3	1.25	AfC3	Text sent to all patients to notify results are available	Identified through pilot costing
Results	Text Message	0.05	Item	1.00	1	0.05		Text notification undertaken by lab. Cost included in overall price	Estimate by CSO manager
Results	Admin Time (letter)	0.42	Item	1.00	6	2.50	AfC3	Text notification undertaken by lab. Cost included in overall price	Estimate by CSO manager
Results	Letter (paper/ printing and postage)	0.60	Item	1.00	1	0.60			Estimate of print cost and 2nd class post
Results	Admin time (email result)	0.42	Minute	1.00	6	2.50	AfC3		Estimate by CSO manager. Cost based on PSSRU 2015 AfC Band 3 Hospital-Based Nurse
Results	Nurse (phone result)	0.73	Minute	1.00	6.5	4.77	AfC6	Positive patients only	Estimate by CSO manager. Cost based on PSSRU 2015 Nurse Specialist (Community)
Results	Helpline - Admin	0.42	Minute	1.00	10	4.17	AfC3	Undertook study for 8 days. Based on average of 138 tests per week, 11 calls per week	Estimate by CSO manager. Cost based on PSSRU 2015 AfC Band 3 Hospital-Based Nurse
Trt	Pharmacist (LES)	0.95	Minute	1.00	17	16.19			Time from Pharmacist Interview. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15
Trt	Azithromycin (Community Pharmacy)	1.81	Item	1.00	1	1.81		All patients on pathway treated with Azithromycin	http://www.drugtariff.nhsbsa.nhs.uk/#/00280039-DC/DC00279526/Part%20VIIIA%20products%20A Dec 2015
Trt	CaSH Service - Nurse	0.73	Minute	1.00	15	11.00	AfC6		Estimate by CSO manager. Cost based on PSSRU 2015 Nurse Specialist (Community)
Trt	Azithromycin (Hospital Pharmacy)	2.22	Item	1.00	1	2.22		Drugs sourced via hospital pharmacy	Drug cost provided by provider

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (Mins)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Trt	STI Literature	0.06	Item	3.00	1	0.18		CSO manager advised given to patients at CaSH clinic	Adams et al., (2014) Sup Info
Trt	Male Condom	0.06	Item	10.00	1	0.60		CSO manager advised given to patients at CaSH clinic	Adams et al., (2014) Sup Info
PN	PN Contact Slips	0.05	Item	3.00	1	0.15			
Trt	GP	1.97	Minute	1.00	10	19.67			PSSRU 2015 GP Cost
Trt	Azithromycin (Community Pharmacy)	1.81	Item	1.00	1	1.81			http://www.drugtariff.nhsbsa.nhs.uk/#/00280039-DC/DC00279526/Part%20VIIIA%20products%20A Dec 2015
Trt	Pharmacist (Dispensing FP10)	0.95	Minute	1.00	5	4.76			Time from Pharmacist Interview. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15
Trt	Dispensing Technician	0.48	Minute	1.00	5	2.42	AfC4	Pharmacy technician maps to AfC band 4	Time from pharmacist interview. Cost from 2014/15 PSSRU Community based scientific and professional staff band 4.
Trt	GUM Clinic Attendance for Treatment & PN	36.16	Item	1.00	1	36.16		Calculation from data (Adams et al., 2014)	Adams et al., (2014) Sup Info
Follow Up	Nurse	0.73	Minute	1.00	7.5	5.50	AfC6		Estimate by CSO manager. Cost based on PSSRU 2015 Nurse Specialist (Community)

Table 7.27 - NCSP A Costs

Assumptions	
95%	% Results Notification by Text
2%	% Results Notification by Phone
2%	% Results Notification by Email
1%	% Results Notification by Letter
8%	% Calls to helpline
51%	% Treatment by Pharmacy
9%	% Treatment by GP
27%	% Treatment by CaSH
13%	% Treatment by GUM

Table 7.28 - NCSP A Assumptions

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (Mins)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Results	Text Message (Negatives)	0.05	Item	1.00	1	0.05		Text notification undertaken by lab. Cost included in overall price	Estimate by CSO lead
Results	Nurse (positive)	0.87	Minute	1.00	17	14.73	AfC7	Positive patients only	Estimate by CSO lead. Cost based on PSSRU 2015 Advanced Nurse (Community)
Trt	Pharmacist (LES)	0.95	Minute	1.00	17	16.19			Time from Pharmacist Interview. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15
Trt	Azithromycin (Community Pharmacy)	1.81	Item	1.00	1	1.81		All patients on pathway treated with Azithromycin	http://www.drugtariff.nhsbsa.nhs.uk/#/00280039-DC/DC00279526/Part%20VIIIA%20products%20A Dec 2015
Trt	CaSH Service - Nurse	0.73	Minute	1.00	15	11.00	AfC6		Estimate by CSO manager. Cost based on PSSRU 2015 Nurse Specialist (Community)
Trt	Azithromycin (Hospital Pharmacy)	2.22	Item	1.00	1	2.22		Drugs sourced via hospital pharmacy	Drug cost provided by provider
Trt	STI Literature	0.06	Item	3.00	1	0.18		Cost unidentifiable from budget statements	Adams et al., (2014) Sup Info
Trt	Male Condom	0.06	Item	10.00	1	0.60		Cost unidentifiable from budget statements	Adams et al., (2014) Sup Info
PN	PN Contact Slips	0.05	Item	3.00	1	0.15		Cost unidentifiable from budget statements	Adams et al., (2014) Sup Info
Trt	GP	1.97	Minute	1.00	4	7.87		No appointment needed, prescription prepared on basis of faxed nurse assessment.	PSSRU 2015 GP Cost
Trt	Azithromycin (Community Pharmacy)	1.81	Item	1.00	1	1.81			http://www.drugtariff.nhsbsa.nhs.uk/#/00280039-DC/DC00279526/Part%20VIIIA%20products%20A Dec 2015

Step	Cost Input	Cost (£)	Cost Type	Quantity	Time (Mins)	Total Cost per Patient (£)	Staff Grade	Notes	Source
Trt	Pharmacist (Dispensing FP10)	0.95	Minute	1.00	5	4.76			Time from Pharmacist Interview. Cost from PSSRU 2012/13 Community Pharmacist analysis uplifted by HCHS Pay & Prices Inflation to 2014/15
Trt	Dispensing Technician	0.48	Minute	1.00	5	2.42		Pharmacy technician maps to AfC band 4	Time from pharmacist interview. Cost from 2014/15 PSSRU Community based scientific and professional staff band 4.
Trt	GUM Clinic Attendance for Treatment & PN	36.16	Item	1.00	1	36.16		Calculation from data (Adams et al., 2014)	Adams et al., (2014) Sup Info
Follow Up	Nurse	0.73	Minute	1.00	5	3.67	AfC6		Estimate by CSO lead. Cost based on PSSRU 2015 Nurse Specialist (Community)

Table 7.29 - NCSP B Costs

Assumptions	
92%	% Test Negative (Text)
8%	% Test Positive (Phone Call)
51%	% Treatment by Pharmacy
9%	% Treatment by GP
27%	% Treatment by CaSH
13%	% Treatment by GUM

Table 7.30 - NCSP B - Assumptions

Table 7.31 summarises the cost per patient for the two comparator pathways – two GUM clinics and two NCSP internet testing pathways.

Cost per Patient	GUM A (£)	GUM B (£)	NCSP A (£)	NCSP B (£)
Results Notification (Negative)	2.13	4.78	1.81	0.05
Results Notification (Positive)	5.41	16.70	1.81	14.73
Average Treatment Cost	18.07	36.16	26.97	22.88
Average Positive Patient Pathway Cost	23.48	52.86	28.78	24.15

Table 7.31 - Summary Comparator Pathway Costs. Average treatment cost includes the cost of treatment and partner notification at GUM clinic, average positive patient pathway cost includes the cost of positive results notification, treatment and partner notification.

The variation in cost per patient between GUM Clinic A and GUM Clinic B is more than double. On investigation into the possible causes of this it was noted that it is not possible to identify how the authors (Turner et al., 2014) derived the unit costs for staffing. Therefore, the cost per patient was recalculated using the 2015 Unit of Health and Social Care costs (PSSRU, 2015) for staffing costs to make it directly comparable. The revised comparator costings are presented in table 7.32, and used in a further costing for pathway options in this chapter.

Cost per Patient	GUM A (£)	GUM B (£)	NCSP A (£)	NCSP B (£)
Results Notification (Negative)	2.13	4.16	1.81	0.05
Results Notification (Positive)	5.41	13.63	1.81	14.73
Average Treatment Cost	18.07	31.47	26.97	22.88
Average Positive Patient Pathway Cost	23.48	45.10	28.78	24.15

Table 7.32 - Summary Comparator Pathway Costs with GUM Clinic B re-costed using PSSRU 2015 staff costs. Average treatment cost includes the cost of treatment and partner notification at GUM clinic, average positive patient pathway cost includes the cost of positive results notification, treatment and partner notification

The OCCP interfaces with existing services at the following points:

- Results notification – where a patient does not access the OCCP to obtain results within seven days the patient reverts to the originating service, in costing terms there are four options as above,
- GUM Clinic treatment – where a patient does not complete the pathway online they are referred to a GUM clinic to complete their treatment. There are two options in this costing exercise – GUM Clinic A and GUM Clinic B.

The cost per patient for each of the combinations of interface with existing pathways are shown in tables 7.33 – 7.35. Table 7.33 outlines the cost per patient of results notification.

Cost per Patient	OCCP Only (£)	OCCP/ NCSP A (£)	OCCP/ NCSP B (£)	OCCP/ GUM A (£)	OCCP/ GUM B (£)
Results Notification (Negative)	0.14	0.32	0.27	n/a	n/a
Results Notification (Positive)	0.14	2.02	0.23	1.10	2.60

Table 7.33 - Results Notification Costs per Patient

This illustrates the impact of the variability of the cost in comparator pathways for patients who choose not to use the OCCP to access their results. If all patients accessed their result through the OCCP system, then compared to the comparator pathways it would represent the lowest cost option for results notification in all circumstances except when compared with NCSP B results notification for negative results where it is more expensive. However, this cost of results notification was difficult to quantify for the interviewee as the cost is bundled into the service they purchase from an external provider and the cost cited was based on the knowledge that this is an automated system driven text.

The costs of online treatment are shown in table 7.34. These costs reflect the costs of treatment of patients who complete their treatment via the OCCP with no complications.

	OCCP/ NCSP A (£)	OCCP/ NCSP B (£)	OCCP/ GUM A (£)	OCCP/ GUM B (£)
Online Treatment Only	11.34	11.34	10.64	10.64
Full Pathway (online only)	19.36	17.58	17.74	19.24

Table 7.34 - Summary of Online Only Pathway Costs. Online treatment only includes online treatment (excluding training costs), partner notification and treatment costs. Full pathway includes the costs of results notification, online treatment (excluding training costs) and health advisor follow up.

The difference in cost between NCSP and GUM online treatment only reflects the costs associated with the health advisor helpline. This was calculated by identifying the average (median) contact time with the helpline for patients originating from GUM and NCSP services and the percentage of participants who contacted the helpline from the two originating service categories.

The full pathway identifies the costs associated with the delivery, including the costs associated with results notification and online treatment (excluding training costs and health advisor follow up). The variance in costs is driven by the impact of integrating the elements associated with existing services, in this case, results notification for patients not accessing their results through the OCCP system. The minor cost variance associated with helpline contact also accounts for the difference. A comparison of the full online pathway costs with the existing comparator pathways is summarised in table 7.35. In all cases where treatment is provided fully online it costs less per patient than the existing comparator pathways.

	NCSP A (£)	NCSP B (£)	GUM A (£)	GUM B (£)
Online Treatment Only (OCCP)	11.34	11.34	10.64	10.64
Treatment Cost Only (comparator pathways)	26.97	22.88	18.07	36.16
Full Pathway (online only) (OCCP)	19.36	17.58	17.74	19.24
Average Positive Patient Pathway Cost (comparator pathways)	28.78	24.15	23.48	45.10

Table 7.35 - Comparison of OCCP and existing GUM and NCSP pathways.

It is recognised however that not all patients commencing the online pathway for treatment will complete their treatment through this route. There can be a number of reasons for this including symptoms, allergies or medical conditions which preclude online care being delivered safely (Estcourt and Gibbs, 2016). In the exploratory study such patients were directed to a GUM clinic to receive treatment. In considering the average cost per patient of the online service, factoring in patients who are diverted from the online pathway into GUM clinics, the average cost per patient is outlined in table 7.36.

	OCCP (NCSP) GUM A (£)	OCCP (NCSP) GUM B (£)	OCCP (GUM) GUM A (£)	OCCP (GUM) GUM B (£)
Average Treatment Cost	15.27	20.13	13.93	18.08

Table 7.36 - Average treatment costs for all patients commencing the OCCP

The average treatment costs include the average costs identified for treating patients commencing from an NCSP service (either A or B) or GUM, and receiving their treatment either online or through a GUM clinic (proportionate to the split between the two treatment options in the OCCP pilot for the respective groups of patients), and partner notification.

The average positive patient pathway cost includes the cost of results notification, treatment, partner notification and health advisor follow up. These costs need to take into consideration the variability of costs associated with the interface points between the OCCP and existing services as follows:

- Results notification via NCSP A, GUM treatment by GUM A
- Results notification via NCSP A, GUM treatment by GUM B
- Results notification via NCSP B, GUM treatment by GUM A
- Results notification via NCSP B, GUM treatment by GUM B
- Results notification via GUM A, GUM treatment by GUM A
- Results notification via GUM B, GUM treatment by GUM B.

For results notified by the GUM service it is assumed that patients would receive their treatment within the same service if they were unsuitable to receive treatment via the online pathway. The average patient costs for the OCCP and existing service combinations are presented in table 7.37.

	NCSP A GUM A (£)	NCSP A GUM B (£)	NCSP B GUM A (£)	NCSP B GUM B (£)	GUM A GUM A (£)	GUM B GUM B (£)
OCCP Average Positive Patient Pathway Cost	17.29	22.15	15.50	20.36	15.03	20.69

Table 7.37 - Average Positive Patient Pathway Costs for OCCP

The average positive patient pathway costs for the comparator pathways are shown in table 7.38.

	GUM A (£)	GUM B (£)	NCSP A (£)	NCSP B (£)
Average Positive Patient Pathway Cost (comparator pathways)	23.48	45.10	28.78	24.15

Table 7.38 - Average Positive Patient Pathway Costs for Comparator Pathways

This shows the range of costs associated with treatment of all patients commencing the OCCP is in the range of £15.03 to £22.15, whereas the range of costs associated with chlamydia treatment in the four existing services costed ranges from £23.48 to £45.10. These differences in cost can in be explained by the significant variation identified in the delivery of care between the four pathways. Comparing the differences between the delivery of the GUM Clinic A and GUM Clinic B services:

- GUM A has a patient group direction in place which enables nurses to deliver the service for chlamydia treatment without input from a doctor. The results notification process whereby all positive patients have a phone call with the clinic ensure that patients who are asymptomatic and only positive for chlamydia are treated through this route.
- GUM B costing identified the input of medical staff into the delivery model and is based on the pathway mapping work undertaken by Adams et al (2014). The pathway costing used is designated that the primary purpose of the visit is chlamydia treatment only (i.e. there is no secondary reason for the visit e.g. further testing/ a positive test result for another STI). Secondly the estimates of time to notify positive patients of results are significantly higher in this pathway costing than those identified in GUM Clinic A. Assuming the same proportion of positive patients in both settings leads to higher costs for results notification.
- NCSP A offer all patients a choice of four results notification options and four choices of treatment. The service lead indicated a number of manual processes to accommodate this.

- NCSP B use text notification for all results, with all positive patients being asked to contact the chlamydia screening office. During this call the nurse runs through questions which form the PGD to support the decision making on where the patient should attend for treatment, with the majority being encouraged to the pharmacy route. For patients receiving treatment via a community pharmacy consultation they are asked the same questions twice and effort is duplicated on the part of healthcare professionals. However, for patients choosing treatment via their GP, the detail recorded by the nurse is shared with the GP practice and a prescription is issued by the GP on the basis of this so this removes the need for a GP appointment.
- Both NCSP services include a follow up call by a health advisor (or nurse) at which partner notification is addressed if it hasn't been taken up by the patient at the point of treatment.
- Neither GUM service indicated any health advisor follow up. GUM A stated that patients were advised about the circumstances under which they would need to contact the clinic for further advice, GUM B pathway documentation provided no indication that this step had been costed. Whilst this is consistent in comparing the costs between the two comparator options this has been included in the OCCP as it is a recognised requirement of the guidelines for the management of chlamydia (BASHH, 2006). The average cost of health advisor follow up within the OCCP pathway is £6.00.

7.6.2 Sensitivity Analysis

From the literature reviews and the interviews to map pathways as part of the primary costing study, the following were identified as the key variables impacting on cost of delivering chlamydia results notification and treatment via the OCCP:

- System costs associated with the OCCP eHealth clinic e.g. hosting and maintenance
- Costs associated with the helpline – call length and the percentage of people accessing the helpline
- The impact of variation on the percentage of the population completing the pathway entirely online.

A number of one-way sensitivity analyses were undertaken on the OCCP costs to assess the impact of these. The analysis undertaken is outlined below and the results are presented in table 7.39:

- OCCP system costs – costs halved and doubled
- Helpline cost (results, treatment and follow up stages) – call length lower quartile and upper quartile values for each stage
- Online completion – percentage of people successfully completing the pathway online – 50%, 60%, 70% and 80%
- Helpline access – 30% and 100% of people access the helpline at the results and treatment stage
- An overall average positive patient pathway cost was then identified for the lowest and highest cost parameters from the sensitivity analysis.

Average Positive Patient Pathway Cost	GUM OCCP £	NCSP OCCP £
Base Case[7]	17.86	18.83
A - System Cost Halved	17.32	18.28
B - System Cost Doubled	18.94	19.92
C - Helpline Cost Lower Quartile	16.83	17.33
D - Helpline Cost Upper Quartile	18.49	21.36
E - Online Completion 70%	17.99	18.03
F - Online Completion 80%	16.15	16.18
G - Online Completion 60%	20.00	20.28
H - Online Completion 50%	21.65	21.74
I - Telephone Helpline 100%	19.24	18.90
J - Telephone Helpline 30%	17.20	17.13
K - Lowest Cost Options (A, C, F, J)	14.61	13.88
L - Highest Cost Options (B, D, H, I)	25.29	25.70

Table 7.39 - Sensitivity Analysis Results

Comparing the one-way sensitivity analysis results for the OCCP it can be seen that the range of average cost per patient for GUM patients is £16.15 to £21.65 and NCSP internet testing pathway patients of £16.18 to £21.74. In all cases this is below the average cost per patient in comparator pathways (GUM clinic average cost per positive patient £34.29, range £23.48 - £45.10, NCSP internet testing pathway average cost per positive patient £26.46, range £24.15 - £28.78). Examining the impact of the combination of the lowest and highest cost options for the parameters from the sensitivity analysis, the highest cost options for both GUM and NCSP internet testing patients using the OCCP are below the average positive patient pathway costs for the GUM and NCSP comparative options (£34.29 and £26.46 respectively).

7 - The base case value is derived from the average of the positive patient pathway costs in table 7.37

However, if the highest cost options are combined (system costs double the base case, helpline cost upper quartile value, 50% of people successfully completing the pathway online and 100% of people completing the pathway online needing to contact the helpline) then the average cost per positive patient completing the OCCP increases to £25.29 and £25.70 for GUM and NCSP internet testing patients respectively. This is higher than the lowest cost comparator pathway included in the costing study (£23.48 and £24.18 respectively).

7.7 Consequences

The OCCP exploratory study identified a number of primary and secondary outcomes, these are summarised in table 7.40. Of these outcomes, two are key parameters for the model presented in Chapter 8 – the proportion of people receiving appropriate clinical management (treatment uptake) and the proportion of sex partners treated. As the model is a static model, time to treatment was not a relevant consideration.

	Proportion of people receiving appropriate clinical management	Time from index diagnosis to treatment	Proportion of sex partners treated	Time from index diagnosis to partner treatment
OCCP GUM	97%	43% Same day as results notification 76% by end of day after results notification	38% (note – combined GUM & NCSP outcome)	Not reported
OCCP NCSP	89%	45% Same day as results notification 67% by end of day after results notification	38% (note combined GUM and NCSP outcome)	Not reported

Table 7.40 - Summary of OCCP Exploratory Study Outcomes (Estcourt and Gibbs, 2016).

The outcomes identified from the literature review detailed in section 7.4 are summarised in tables 7.17 and 7.18, along with their limitations. From the interviews with commissioners and service providers as part of the primary costing study, limited information was available on the outcome measures which are directly comparable to the OCCP. Although it was identified that these data should be identifiable from routine datasets, interviews revealed that it is not possible to routinely identify this information from the national data submissions, particularly following the decision to change the NCSP datasets in 2013 so that elements previously reported such as treatment uptake are no longer reported. Interviews with commissioners revealed that their monitoring focus is on indicators which support the achievement of the PHOF indicator of 2,300 diagnoses per 100,000 population.

7.8 Results Summary

The costs and outcomes (where a value has been identified for OCCP and at least one of the comparator options) identified are presented in table 7.41.

	GUM OCCP	NCSP OCCP	GUM[1]	NCSP[2]
Average Positive Patient Pathway Cost	£17.86	£18.82	£34.29	£26.47
Percentage of index patients receiving treatment	97%	89%	99% (range 72%-99%)	93.45% (range 91.6-93.45%)
Time from index diagnosis to treatment (note cumulative percentage)	43% Same day 76% by end of day after	45% Same day 67% by end of day after		10.3% same day 12.5% by end of day after
Percentage of partners treated	38%	38%	55% (range 46.9% - 90%)	46% (range 45% to 75%)

Table 7.41 - Summary of Costs and Outcomes ([1] – See table 7.16 for references, [2] – See table 7.17 for references)

Meta-analysis of findings for comparator pathways from the literature review was not undertaken as the reporting of studies was not sufficiently clear. Therefore, the 'base case' value identified in table 7.41 is derived from the study with the largest sample size and the range represents the lowest and highest average values identified from the studies included in the literature review. Presenting the costs and outcomes separately enable decision makers to make their own assessment of the findings which is one of the benefits of a cost-consequence analysis approach (Drummond et al., 2005).

This is of particular significance in pathways such as sexual health services where the commissioners and providers are split across different element of the pathways. In the case of chlamydia for example, the focus of LA commissioners is the delivery of testing and treatment services, whereas the focus of CCGs is the provision of services that manage the long-term consequences associated with untreated chlamydia. Given the split in commissioning responsibilities is still relatively new (2013) it is not yet clear whether there has been any material change in decision making arising from this.

Whilst Drummond and colleagues identify the presentation of costs and outcomes separately as a benefit, Mauskopf and colleagues point to it being a risk, in so far as "the weighting of the relative importance of different costs and benefits is left to each decision maker" (Mauskopf et al., 1998:282). No suggestion is offered as to a resolution to this risk, and examples of how weighting by decision makers is managed in CCA has not been identified in any published studies that have been reviewed.

The costing study has demonstrated that utilising the OCCP as a method for results notification, treatment and partner notification has the potential to deliver a service at a lower cost per positive patient than existing pathways. The average cost per patient includes the cost of treatment via a GUM clinic for those patients who are unable to complete the online pathway. The outcomes deliver a mixed picture, with time from index diagnosis to treatment being considerably better than current pathways and the percentage of people receiving treatment being broadly similar. However, the percentage of partners treated is significantly lower than existing pathways. The partner notification results should be interpreted with caution owing to the low numbers of partners who were registered on the system by index patients logging on to access treatment via the system (13 partners of NCSP index patients and 15 partners of GUM index patients) and therefore the measure is heavily dependent on index notification at health advisor follow up (Estcourt and Gibbs, 2016).

7.9 Discussion

The costing study and review of outcomes offer early insight into the likely impact of the OCCP technology on the cost of delivery and outcomes compared with existing practice. It also highlights issues to be taken into consideration in its future development and further research. It demonstrates that the OCCP is likely to be cost saving when implemented alongside existing pathways, however the proportion of patients requiring treatment via clinic demonstrates that its implementation could only be as an alternative treatment option as opposed to a replacement one. Based on the proportion of patients completing treatment online or in a GUM clinic within the pilot study, the technology offers a saving of £6.86 per positive NCSP patient treated and £16.10 per positive GUM patient treated compared with existing pathways.

A key strength of the study is that it uses comparator pathways mapped within the last 12 months so they are reflective of current service delivery models to compare the OCCP to. The study identifies the key parameters within the costing where variance will impact on the cost per patient, across the OCCP and comparator pathways.

There are a number of limitations to this study, firstly it is a costing study based on an exploratory study involving small number of patients (the exploratory study was powered for non-inferiority). The exploratory study focused specifically on the OCCP and did not collect any primary data on comparator pathways, specifically in terms of outcomes. Participants opted into the study, there was no randomisation of participants between the OCCP and control (comparator) pathways therefore there is the potential for bias in the results. No information is known about the individuals who chose not to consent other than they met the inclusion criteria for the study. Whether there is anything significant about this cohort of patients which would impact on costs is unknown. This is significant in the context of costing the service as the rate of completion of the pathway online is a key determinant in the cost of the service.

Data for the costing study was collected primarily from the OCCP system, literature review and interviews with those directly involved in the commissioning or provision of services. As demonstrated in the results section, both cost and outcome parameters for comparator pathways were not well estimated in the literature, and variability in data quality is a recognised weakness of a cost consequence analysis approach (Mauskopf et al., 1998). As discussed in the methods section this impacts on the level of precision with the costing however, this was accepted given the stage of technology development and scale of the exploratory study.

Despite the limitations identified, within the context of the stage of technology development the findings are helpful in informing future research and development. The study exposed issues with data collection as part of the exploratory study, in particular the capture of data on access to the helpline was undertaken in an Excel spreadsheet meaning that records of calls were not linked directly into the database capturing the patients' responses to the OCCP. Secondly it was not possible to disaggregate time spent by health advisors on research related activities e.g. service evaluation questions at the end of the health advisor follow up call and service delivery activities such as the follow up call itself. In considering future research in respect of the OCCP, it is accepted that a randomised control trial is the next step. It is recommended that the 'back end' of the system is revised to enable the capture and recording of all data connected with the delivery of the pathway in the same system.

Further consideration also needs to be given for clinician support to the health advisors running the OCCP. It is recognised, although was not quantified, that the sexual health clinician leading the OCCP spent time providing support to the health advisors running the helpline. On reflection when interviewed afterwards it was believed that the majority of this activity related to issues with the OCCP and standard operating procedure (SOP) for health advisors which arose in the course of the study. However, there were a small number of patients identified where clinical advice was provided to the health advisors on the management of the patient. Consideration needs to be given in any future trial as to whether this advice should in fact be given, and if so the resource use captured, or whether if patients do not fit the clinical algorithm and SOP they should be directed into a clinic.

As part of the next phase of research it may also beneficial to consider patient costs. Whilst this is not a requirement for consideration in an economic evaluation for adoption into mainstream services in England it is recognised that uptake is a key consideration in achieving cost effectiveness (Tate et al., 2009). It is recognised that the majority of patients already have access to the base technology required (e.g. computer, smartphone, internet connection), and the qualitative research undertaken with people who completed the pathway indicated they believed it to be more convenient that traditional pathways (Aicken et al., 2016).

Another key issue to consider in the next phase of the research is generalizability of the findings to mainstream practice. As demonstrated in section 7.6 there is significant variance in the delivery models of the four pathways costed, which in turn impact on the average cost per positive patient. From the author's experience as an NHS manager a key question is how do the costs of the OCCP compare with an optimised current pathway? A second consideration is the costs of running the OCCP compared with the costs of running existing services. At present the costs of both are presented on an average cost per positive patient basis however this analysis does not consider the impact of the operational delivery.

For example, the cost requirements to run the helpline or a clinic for eight hours a day and the demand requirements to ensure effective utilisation of the capacity. A final consideration for future research identified draws together the findings of the costing study and the stated preference study, to explore the impact of preferences in the design of the clinical care pathway. For example, considering variation to the OCCP to provide access to a health care professional via instant messaging as the DCE indicated that there is no statistically significant difference in preference between instant messaging and face-to-face contacts, whereas it suggests that there is a statistically significant difference for participants in the DCE for face-to-face contact compared with phone contact.

Considering where this study sits within the context of other published studies, this is the first review of the costs and consequences of an OCCP for chlamydia which requires no input from a health care professional to prescribe medication. Bracebridge and colleagues explore the cost effectiveness of a fully remote chlamydia testing and treatment pathway with a doctor reviewing responses to an online questionnaire prior to prescribing the treatment and found that costs per positive diagnosis were 3.5 times higher than the NCSP average, however this includes the costs of testing and running the screening programme (Bracebridge et al., 2012). A similar study to the Bracebridge and colleagues study was identified in California which centred on the use of website for test ordering and results notification, with an option for collecting treatment from a pharmacy or attending treatment (Spielberg et al., 2014).

This demonstrated a preference for remote a remote testing and treatment pathway but provides insufficient cost detail other than to indicate that it is potentially lower cost than existing options (ibid).

7.10 Summary

This chapter offers valuable insight into the likely costs of implementation of a novel online clinical care pathway for the treatment of chlamydia. The preliminary costing analysis shows that it has the potential to be less expensive per patient than existing pathways, while the exploratory study indicates that treatment uptake rates are broadly comparable for index treatment but notably lower for partner treatment. Sensitivity analyses have demonstrated that the OCCP is cost saving compared with existing pathways in all scenarios except a combination of all of the most costly options for parameters.

The pathway mapping undertaken as part of the costing study has demonstrated that there is significant variance in the way that chlamydia treatment services are currently delivered which have a material impact on cost. This is an area which service providers would benefit from exploring further as it demonstrates opportunities for saving cost within existing delivery models. One other important finding from the literature review and costing study is that with the exception of Turner and colleagues (2014), current pathway delivery models are not reflected in previous published studies considering the cost-effectiveness of chlamydia testing and treatment.

In the next chapter the broader impact of the adoption of a fully remote online pathway for chlamydia will be considered in a decision analytic model to offer further insight into the factors which may influence the clinical and cost-effectiveness of online care.

CHAPTER 8 – EARLY ECONOMIC EVALUATION OF THE OCCP & A FULLY REMOTE ONLINE PATHWAY FOR THE TESTING & TREATMENT OF CHLAMYDIA

8.1 Introduction

There are widely recognised benefits to using decision analytic modelling within stage II economic evaluation to inform the eHTA process. In particular, it has a key role to play in:

- Synthesising data from a number of sources relating to cost and consequences;
- Determining the point at which the value of variables indicate that the new technology is likely to be cost-effective;
- Informing the development of future economic evaluation to be undertaken alongside RCTs (Sculpher et al., 1997).

Given the stage of development of the OCCP and fully remote online pathway decision analytic modelling offers a framework in which data can be incorporated from a wide range of sources, recognising the only data currently available is from an exploratory study. It also has advantages over single study based economic evaluation because it enables the consideration of the longer-term consequences of untreated chlamydia which could not be captured in a trial (Briggs et al., 2006).

In Chapter 7 the costs and outcomes per average patient were identified for the OCCP, testing the concept of a fully remote online pathway from results notification to health advisor follow up. This chapter takes forward this work to:

- Develop a decision analytic model to conduct an economic evaluation of the OCCP and the fully remote online pathway compared to current practice

- Explore the uncertainty in model parameters through sensitivity analyses
- Apply the findings from the DCE to investigate the impact of uptake of testing and treatment on the costs and outcomes of using this new care pathway for chlamydia testing and treatment in England.

This chapter describes the modelling in two parts, firstly focusing on the impact of the OCCP, taking forward the work presented in chapter 7, and secondly exploring the potential impact of the full pathway compared to the GUM clinic pathway and NCSP internet testing pathway. The self-test technology, which is being developed by the eSTI^2 Consortium, is not yet ready for implementation into clinical practice or as a pilot (as of 2016). Thus, this work explores hypothetical scenarios to examine how the new test's parameters and associated costs would impact on the full chlamydia testing and treatment pathway. As a result, this model can be used to establish the optimum cost for the NHS for the eSTI^2 technology once its diagnostic parameters are known.

8.2 Methods

The analysis was undertaken to inform the future development of the OCCP, self-test technology and service pathways against a backdrop of increasing policy emphasis on the development and implementation of digital technology within the NHS in England. As outlined in section 3.5.1, a decision analytic model was selected for the following reasons:

- This is an early stage evaluation of a new technology and therefore the objective is to demonstrate the likely impact on costs and outcomes to inform future research and development;

- Data for parametrising a model about the new technology are somewhat limited, with no data on self-testing (Stages 1 and 2 in pathway E, figure 2.1) and only initial results and costings for the OCCP (Stages 3 to 6 in pathway E, figure 2.1);
- It is not yet known how the availability of self-tests may influence sexual behaviours, risk taking and testing patterns, all of which would be material considerations within a dynamic model to inform parameters such as partner change rate;
- Whilst it is recognised that dynamic models are superior to static models for modelling infectious diseases (Barton et al., 2004, Roberts et al., 2008) it also recognised that they are more complex, costlier and time consuming to develop.

8.2.1 Conceptualising the Model

The perspective selected for the model is that of NHS provider. This included the direct costs to the provider of delivering the service and excluded patient related costs. This is in line with the approach outlined in the MTEP methods guide which states that "models should capture and quantify the impact of introducing a new technology into current healthcare pathways and routine NHS use" (NICE, 2011b:17).

The setting for the model was mainstream sexual health services in England. The descriptor of 'mainstream sexual health services' was defined as sexual health services commissioned by LAs to meet their statutory obligation to provide open access sexual health services in their local area, which are free at the point of delivery (HM Government, 2013).

The disease focus of the model was *Chlamydia Trachomatis*. This was restricted to genital *Chlamydia Trachomatis* (excluding *Chlamydia Trachomatis* infections of other sites). The target population identified was defined as the general population, recognising that sexual health services are an open access diagnostic service. It should be noted that whilst the age range for the NCSP is 16-24 year olds, within this analysis no assumptions were made regarding an upper age limit. Population subgroups considered in the analysis included men and women who tested positive for genital chlamydia only owing to the different potential long term complications arising from untreated chlamydia.

The two pathways selected for comparison were:

- The GUM clinic pathway,
- The NCSP internet testing pathway.

The reasons for selecting these two options for comparison were that they represent two of the main pathways of established care within mainstream sexual health services, and they reflect the pathways from which patients were sourced for the OCCP exploratory study that were mapped from results notification onwards as part of the OCCP costing study presented in Chapter 7.

8.2.2 Model Structure

The structure of the model was informed by both a review of static models used to consider the cost-effectiveness of chlamydia testing and treatment, and the mapping work to understand chlamydia testing and treatment pathways undertaken as part of the costing study. From the literature review presented in Chapter 6, this included static models presented by Hislop et al., (2010), Turner et al., (2011) and Turner et al., (2014). In addition, Roberts (2008), presented a summary of static structures used to evaluate chlamydia screening. A simplified presentation of the developed decision tree is shown in figure 8.1.

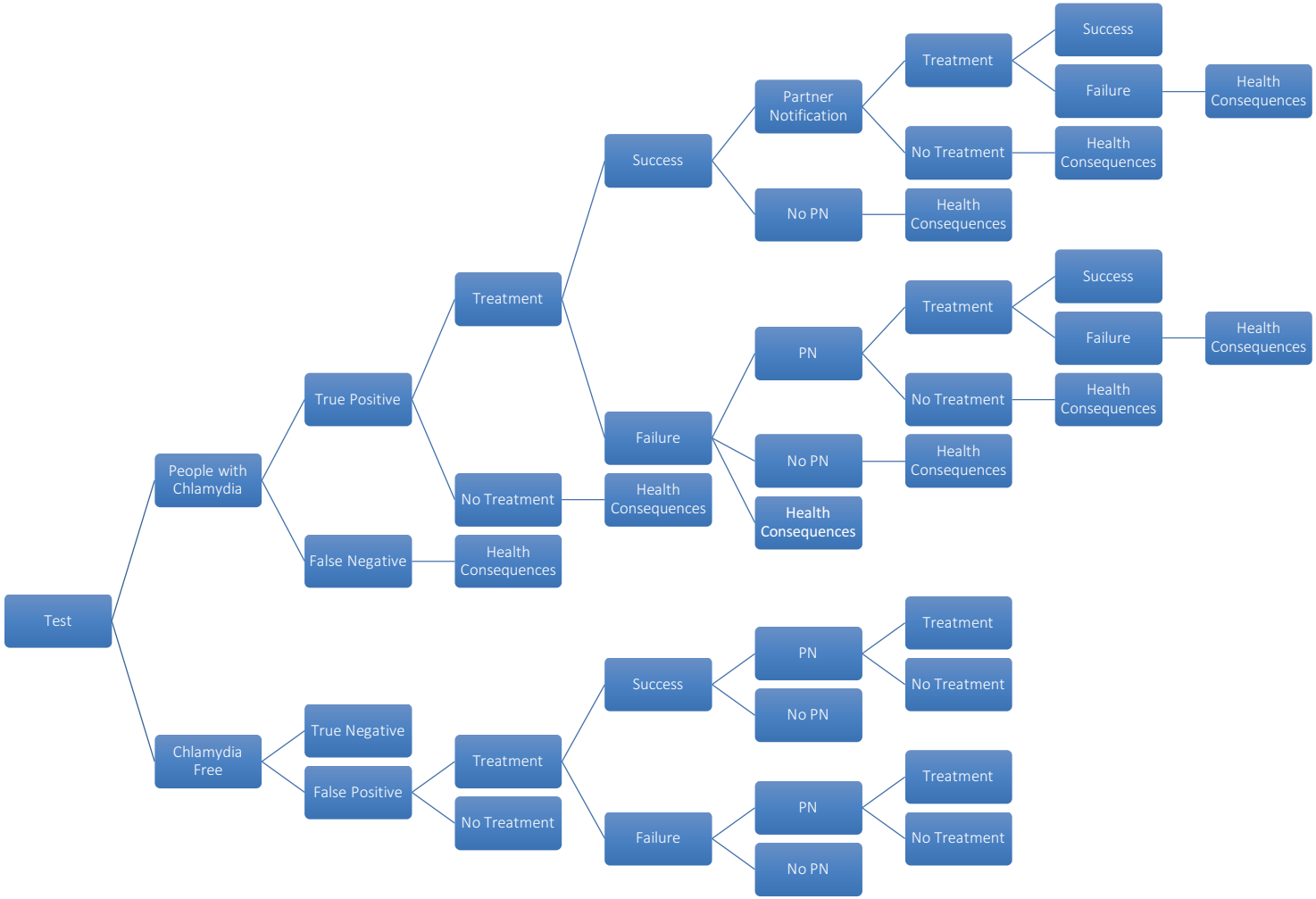

Figure 8.1 - Simplified Decision Tree Underpinning Model

8.2.3 Model Assumptions & Parameters used in the Economic Model

The model was populated with parameters drawn from a number of data sources, including published studies, national datasets and primary data sources. The following sections outline the assumptions in respect of population, disease, uptake of treatment and partner notification, major outcomes – health complications resulting from untreated chlamydia and test parameters.

8.2.3.1 Population

The model was created to start at decision to test. The model contains three parameters (population tested, proportion of tests – male and female, and pregnancy rate) that can be varied with respect to the population, which are summarised in table 8.1. These parameters are constant across all pathways within the model.

Parameter	Definition/ Assumptions	Source	Base Case Values
			All Pathways
Population Tested	Model demonstrated with a theoretical cohort of 100,000 patients. It is assumed that all patients are over 16.	n/a	100,000
Proportion of Male Tests	Parameter apportions the proportion of the population tested to male. It is assumed that the proportion of males testing is in line with current published data.	Public Health England (2016f)	29.8%
Proportion of Female Tests	Parameter apportions the proportion of the population tested to female. It is assumed that the proportion of females testing is in line with current published data.	Public Health England (2016f)	70.2%
Pregnancy Rate	Pregnancy rate for 16-44 population taken from national data source.	Office for National Statistics (2016a)	7.6%

Table 8.1 - Population Parameters - Assumptions and Base Case Scenario Values

8.2.3.2 Disease – Genital Chlamydia Trachomatis

The model created was a static model. Whilst it does not incorporate transmission dynamics, a number of assumptions were made about genital *Chlamydia Trachomatis* as summarised in table 8.2. The base case assumptions are the same regardless of the pathway because there is no plausible circumstances in which there could be a variation that is driven by the pathway.

Parameter	Definition/ Assumptions	Source	Base Case Values
			All Pathways
Prevalence – Male	General population prevalence taken from NATSAL3. 16-24 age range prevalence applied in model as it is assumed that the testing patterns will continue with the highest proportion of testing in this age range.	Sonnenberg et al. (2013)	2.3%

Parameter	Definition/ Assumptions	Source	Base Case Values
			All Pathways
Prevalence – Female	See above.	Sonnenberg et al. (2013)	3.1%
Treatment Success	It is assumed that all patients are treated with azithromycin which results in a percentage of these patients being chlamydia free.	Lau and Qureshi (2002)	97%
Transmission to neonate	It is assumed that not all chlamydia positive mothers will transmit the disease to neonate.	Barton and Roberts (2007)	45%
Partner Positivity	It is assumed that not all partners of index patients will be positive. Value taken from published NCSP data.	Public Health England (2016a)	62%

Table 8.2 - Disease Parameters - Assumptions and Base Case Scenario Values

It is known that a proportion of chlamydia positive patients experience spontaneous resolution without requiring antibiotics to treat. A recent study estimates this to be approximately 20% between screening and returning for treatment (Geisler et al., 2013). Spontaneous resolution was not incorporated in the model as current pathways do not undertake any retesting prior to treatment.

It is also known that a high proportion of patients will be asymptomatic, as outlined in section 2.4.3. The management of patients attending clinics with symptoms will be different to asymptomatic patients. Therefore, the GUM pathway within the model represents the pathway for asymptomatic patients only.

8.2.3.3 Health Outcomes – Complications Resulting from Untreated Chlamydia

The model incorporated outcome measures in the form of health complications (major outcomes) resulting from untreated chlamydia rather than QALYs for the reasons outlined in section 3.5.1.

This builds upon the work in Chapter 7 to consider the process/ system outcomes defined by the OCCP exploratory study and enables an understanding of the impact of the process measures on health outcomes in the form of complications arising from untreated chlamydia.

If chlamydial infection is left untreated there are a number of consequences for the health of men, women and neonates. Table 8.3 summarises the key complications:

	Complication of Untreated Chlamydia
Men	Urethral Discharge (Urethritis) Epididymitis Orchitis Infertility
Women	Cervicitis Endometritis Salpingitis Pelvic Inflammatory Disease (PID) Infertility Preterm rupture of membranes (PROM) Parihepatitis
Both Sexes	Proctitis Pharyngitis Reiter's Syndrome
Neonates	Conjunctivitis Pneumonia

Table 8.3 - Consequences of Untreated Chlamydial Infection (WHO, 2011b)

PID in women and epididymitis in men are recognised consequences of untreated chlamydia (WHO, 2007). Of the 2,072 diagnoses of chlamydial PID and epididymitis made in 2015 in England, 2,067 of them were found to be chlamydial PID and epididymitis: 1,511 female and 560 male (Public Health England, 2016c). Mortality is not a recognised consequence of untreated chlamydial infection, therefore the mortality rate was assumed to be zero.(WHO, 2011b).

In their systematic review, Roberts and colleagues consider outcomes as short term e.g. test and treat, cost per case detected or longer term e.g. major outcome averted (Roberts et al., 2012). Of the 29 screening papers and 13 diagnostic test papers considered by these authors, approximately one half considered short term outcomes only. Roberts and colleagues believe these to be inferior to long term outcome measures because they do not provide an indication of the overall success of the screening programme (ibid.). The outcomes used in the literature review of costs and cost-effectiveness outlined in Chapter 7 identified a range of short and long term outcomes of chlamydia testing which were summarised in table 7.18.

It can be seen that in terms of outcomes with respect to chlamydia testing and treatment, there are a number that have been adopted in previous cost effectiveness studies (see table 7.11). For sequelae, a review of the literature was undertaken using the complications identified by the WHO (set out in table 8.4) to determine model parameters. This process reduced the number of sequelae for inclusion in the model, and identified ectopic pregnancy, a complication not identified by the WHO, for inclusion in the model.

	Complication of Untreated Chlamydia
Men	Epididymitis
Women	Pelvic Inflammatory Disease (PID) Infertility Ectopic Pregnancy Preterm rupture of membranes (PROM)
Neonates	Conjunctivitis Pneumonia

Table 8.4 - Consequences of Untreated Chlamydia to be Included in the Model

Uncertainty regarding long term sequelae is recognised in the ECDC literature review, which highlights the need for further research to understand the link between chlamydia and pelvic inflammatory disease and "markers of chlamydial infection that predict women at high risk of tubal damage" (ECDC, 2014:3).

The parameters used in the model to estimate the long-term consequences of untreated chlamydial infection are summarised in table 8.5; these are common across all three pathways.

Parameter	Definition/ Assumptions	Source	Base Case Values
			All Pathways
PID	Probability of PID. Assumed to be constant in all pathways.	Price et al. (2016)	17.1%
Infertility	Probability of Infertility. Assumed to be constant in all pathways.	Price et al. (2016)	1.08%
Infertility resulting from PID	Probability of Infertility resulting from PID. Assumed to be constant in all pathways.	Welte et al. (2000)	11%
Ectopic Pregnancy	Probability of Ectopic Pregnancy. Assumed to be constant in all pathways.	Price et al. (2016)	4.9%
PROM	Probability of PROM. Assumed to be constant in all pathways.	Blas et al. (2007)	6%
Neonatal Conjunctivitis	Probability of neonatal conjunctivitis. Assumed to be constant in all pathways.	Welte et al. (2000)	30%
Neonatal Pneumonia	Probability of neonatal pneumonia. Assumed to be constant in all pathways.	Welte et al. (2000)	15%
Epididymitis	Probability of epididymitis. Assumed to be constant in all pathways.	Welte et al. (2000)	2%

Table 8.5 – Major Outcomes Parameters - Assumptions and Base Case Scenario Values

8.2.3.4 *Uptake – Testing, Treatment and Partner Notification*

There are a number of parameters in the model (summarised in table 8.6), which relate to individual choice. Unlike the population, disease and health outcomes parameters outlined in sections 8.2.3.1 – 8.2.3.3, the majority of these parameters vary between the different pathways within the model due to personal choice.

Parameter	Definition/ Assumptions	Source	Base Case Values		
			GUM[1]	NCSP [2]	Online[3]
Testing Uptake	Assumed constant within the base case scenario i.e. based on a theoretical cohort of 100,000 patients.	n/a	100,000	100,000	100,000
Index Treatment Uptake	The percentage of positive patients who elect to pursue treatment. Values taken from OCCP study and published literature.	[1] – BASHH, 2008 [2] – Saunders, 2016 [3] – Gibbs & Estcourt, 2016	99%	88.9%	97% - GUM 89% - NCSP
Partner Notification Advice	All index patient are given advice on notification of partners	Primary Costing Study	100%	100%	100%
Partner Identification Rate	The number of different sex partners identified per index in the last six months	[1] – Challenor et al., 2005 [2] – PHE, personal communication [3] – Gibbs & Estcourt, 2016	1.46 partners per index	1.18 partners per index	3.05 (GUM) 2.80 (NCSP) partners per index
Partner Treatment Uptake	The percentage of partners who are subsequently treated	[1] – McClean et al., 2006 [2] – PHE., 2016 [3] – Gibbs & Estcourt, 2016	55%	58%	38%

Table 8.6 - Uptake Parameters - Assumptions and Base Case Scenario Values

8.2.3.5 Test Parameters

As outlined in section 8.2 the technology was evaluated in two parts - the OCCP (from results notification to health advisor follow up) and the fully remote online pathway (from self-test to health advisor follow up). In the OCCP evaluation, the test parameters were assumed to be constant across all three pathways (see table 8.7). For the fully remote online pathway, the test parameters chosen were the parameters for the test in use at one of the OCCP exploratory study sites. As a result of the absence of a self-test developed by the eSTI[2] consortium, the test parameters used in the base case for the fully remote online pathway and the implications for a self-test were explored further in sensitivity analyses presented in section 8.3.4.

Parameter	Definition/ Assumptions	Source	Base Case Values		
			GUM	NCSP	Online
Sensitivity	True Positive. Data taken from FDA approval summary for BD ProbeTec CT Q^{x} Amplified DNA Assay.	FDA (2008b)	94.5%	94.5%	94.5%
Specificity	True Negative. Data taken from FDA approval summary for BD ProbeTec CT Q^{x} Amplified DNA Assay.	FDA (2008b)	98.9%	98.9%	98.9%
False Positive	Data taken from FDA approval summary for BD ProbeTec CT Q^{x} Amplified DNA Assay.	FDA (2008b)	1.1%	1.1%	1.1%
False Negative	Data taken from FDA approval summary for BD ProbeTec CT Q^{x} Amplified DNA Assay.	FDA (2008b)	5.5%	5.5%	5.5%
Indeterminate	Percentage of tests with an indeterminate result was 0.0281%, therefore assumed to be 0% in the model.	FDA (2008b)	0%	0%	0%

Table 8.7 - Test Parameters - Assumptions and Base Case Scenario Values[8]

[8] - the test parameter values are the same for all pathways in the base case because evaluation of the OCCP did not commence until results notification. For the fully remote online pathway test parameters were assumed to be the same across all pathways in the base case and explored further in the sensitivity analysis

8.2.4 Resource Use & Cost Data

As in Chapter 7, resource inputs were costed at 2015 prices (£GBP); where necessary, the NHS HCHS pay and prices inflation index (Department of Health, 2016a) was applied to inflate costs to 2015 prices.

8.2.4.1 OCCP

Table 8.8 summarises the cost data used in the model to explore the impact of introducing the OCCP at results notification stage for positive patients only. This necessitated the comparison of the OCCP with the GUM clinic pathway and the comparison of the OCCP with the NCSP Internet Testing Pathway as the costs associated with delivery are different. Within the GUM clinic there was a requirement for staff to enter patient details onto the OCCP system whereas for patients originating in the NCSP testing pathway the process was automated.

Parameter	Definition/ Assumptions	Source	Base Case Values			
			GUM	NCSP	OCCP – GUM	OCCP– NCSP
Cost of Testing	Assumed to be £0 in the model when exploring OCCP as pathway starts at results notification	-	£0	£0	£0	£0
Cost of Index Treatment	Includes: results notification, treatment, partner notification, health advisor follow up	OCCP costing study	£34.29	£26.47	£17.86	£18.82
Cost of Partner Treatment	Includes: results notification, treatment, partner notification, health advisor follow up. It is assumed that partners will be treated via the same pathway as index patients	OCCP costing study	£34.29	£26.47	£17.86	£18.82

Table 8.8 – Pathway Costs OCCP - Assumptions and Base Case Scenario Values

8.2.4.2 *Fully remote online pathway*

Within the fully remote online pathway the costs of results notification onwards remain the same as in the OCCP. However, the costs of testing are included in the evaluation. Data for the costs of testing were identified from literature reviews. A number of values for GUM and NCSP internet testing were identified. The base case values outlined in table 8.9 have been taken from nationally published data sources and costs of testing were explored further as part of the sensitivity analyses.

It is important to note the difference between the costings within the OCCP and fully remote online pathway economic evaluations. Within the OCCP the costs of results notification are included in the treatment stage as this is where the OCCP starts. In contrast, within the fully remote online pathway, the costs of results notification are included within the testing stage cost as this is where they are costed in current pathways. Adjustments have been made to costs in the fully remote online pathway to reflect this.

Parameter	Definition/ Assumptions	Source	Base Case Values		
			GUM	NCSP	Online
Cost of Testing	GUM – 2014/15 reference costs NCSP – Preventx reported average cost for testing and results notification Online – as NCSP, adjusted for results notification cost	Department of Health (2015) Public Accounts Committee (2009)	£129	£22.69	£21.29
Cost of Index Treatment	Includes: treatment, partner notification, health advisor follow up. Results notification costs excluded.	OCCP costing study	£24.77	£24.93	£16.89
Cost of Partner Treatment	Includes: treatment, partner notification, health advisor follow up. It is assumed that partners will be treated via the same pathway as index patients	OCCP costing study	£24.77	£24.93	£16.89

Table 8.9 – Pathway Costs Full eSTI[2] Pathway - Assumptions and Base Case Scenario Values

8.2.4.3 *Health Outcomes – Complications Resulting from Untreated Chlamydia*

In addition to the uncertainty regarding long term complications, the literature also identified variation in the costing of the treatment of sequelae. To understand the impact of this issue Ong and colleagues explored the impact of chlamydia sequelae cost estimates on economic evaluations of chlamydia screening programmes (Ong et al., 2016). Their findings demonstrated a considerable variation in the costs associated with the management of sequelae for the UK based studies included in their analysis, summarised in table 8.10.

	Range (Lower) £	Range (Higher) £
Pelvic Inflammatory Disease	171	3,635
Ectopic Pregnancy	953	3,615
Tubal Factor Infertility	546	6,752
Chronic Pelvic Pain	159	(only one study included)
Epididymitis	21	1,008
Neonatal Conjunctivitis	11	903
Neonatal Pneumonia	433	765

Table 8.10 - Range of chlamydia sequelae management costs reported in UK studies. Data at 2013/14 Costs. Source: Ong et al., (2016)

In order to identify a base case value for inclusion in the model an average was taken from the UK studies included in Ong and colleagues. Their study did not report a value for PROM. A search of the published literature failed to identify any published UK studies on costs for the management of PROM; therefore, a cost was taken from NICE medical technologies guidance on the use of the Vision Amniotic Leak Detector (NICE, 2013) and uplifted to 2014/15 costs. The costs for adverse health outcomes were assumed to be constant across all pathways in the model, and the base case values are presented in table 8.11.

Parameter	Definition/ Assumptions	Source	Base Case Values		
			GUM	NCSP	Online
PID	Average costs taken Ong et al., (2016) uplifted to 2014/15 prices	Ong et al. 2016	£1,069.54	£1,069.54	£1,069.54
Infertility	Average costs taken Ong et al., (2016) uplifted to 2014/15 prices	Ong et al. 2016	£4,010.52	£4,010.52	£4,010.52
Ectopic Pregnancy	Average costs taken Ong et al., (2016) uplifted to 2014/15 prices	Ong et al. 2016	£2,532.59	£2,532.59	£2,532.59
PROM	Cost taken from NICE MTG15 (2013), uplifted to 2014/15 prices	NICE 2013	£851	£851	£851
Neonatal Pneumonia	Average costs taken Ong et al., (2016) uplifted to 2014/15 prices	Ong et al. 2016	£706.64	£706.64	£706.64
Neonatal Conjunctivitis	Average costs taken Ong et al., (2016) uplifted to 2014/15 prices	Ong et al. 2016	£31.28	£31.28	£31.28
Epididymitis	Average costs taken Ong et al., (2016) uplifted to 2014/15 prices	Ong et al. 2016	£790	£790	£790

Table 8.11 – Adverse Health Outcome Costs - Assumptions and Base Case Scenario Values

8.2.5 Analysis

The analysis was undertaken on a theoretical cohort of 100,000 people, using ONS population data to determine the split between male and female (Office for National Statistics, 2016c). The total number of patients identified as positive and therefore requiring treatment in the base case was 3,773 (2,704 true positive and 1,069 false positive).

Results are presented separately as costs and outcomes rather than in a measure of cost-effectiveness such as an incremental cost-effectiveness ratio. This approach is adopted in cost consequence analysis, allowing the opportunity for decision makers to consider costs and outcomes separately (Drummond et al., 2005), a list of the costs and consequences presented is summarised in section 8.3.

Within the model the patient cohort is assumed to be homogenous, that is there is no variability between individual patients (Briggs et al., 2006). The model was constructed to enable males and females to be considered separately given the differences in consequences arising from untreated chlamydia. However the results are reported at a pathway level, the costs associated with service delivery for testing and treatment of chlamydia are the same for both sexes.

Eddy and colleagues identify five types of model validation "face validity, verification (or internal validity), cross validity, external validity, and predictive validity" (Eddy et al., 2012:843). To assure the model, the following checks were undertaken:

- The face validity of the model was explored with a sexual health clinician which included the model structure, parameter inputs and results.
- The model was constructed in Excel for Mac 2011 and populated with dummy parameters to test the internal validity of the model. Individual equations within the model and summary tables were checked to ensure computational accuracy prior to populating with the parameters outlined in section 8.2.3 and 8.2.4.

- Other published studies exploring the costs and cost-effectiveness were considered to determine whether cross-validation was possible. Whilst no directly comparable studies were identified, the results of the model were compared with other similar studies and a summary of the findings of this are included in section 8.4.
- External and predictive validation were not undertaken as this is an early economic evaluation and are recognised as not essential (Weinstein et al., 2003).

A key feature of early economic evaluation is that it is indicative rather than definitive and significant parameter uncertainty is one of the main reasons for this (Sculpher et al., 1997). The aim of early economic evaluation is to provide an indication of the likely costs and benefits of a new technology and to identify areas for further consideration for technology developers. Therefore, sensitivity analysis has been undertaken. Reference was made to both the NICE MTEP methods guide (NICE, 2011) and the ISPOR good research practices for parameter estimation and uncertainty (Briggs et al., 2012) to inform the selection of the methods. One way sensitivity analysis was selected as the method so that the impact of varying individual parameters can be seen on the key outcomes to provide insight into the impact on both costs and outcomes. Two way sensitivity analysis was not undertaken as there was no obvious correlation between parameters within the model therefore this may offer a misleading view. Probabilistic sensitivity analysis was not undertaken as it is not appropriate for an early economic evaluation.

8.3 Results

The following sections present the results for the base case values for the OCCP and fully remote online pathway separately. Results are presented for the following measures:

- Total Index Testing Cost
- Total Index Patient Uptake (TP & FP)
- Total Index Treatment Cost
- Total Index Testing & Treatment Costs
- Total Health Complications – Index
- Total Cost of Health Complications – Index
- Total Sex Partners Notified (TP & FP)
- Total Sex Partners Treated
- Total Cost of Sex Partner Treatment
- Total Health Complications – Sex Partners
- Total Cost of Health Complications – Sex Partners
- Average Cost per True Positive Index Patient (excluding health complications)
- Average Cost per Positive (TP & FP) Index Patient (excluding health complications)
- For the fully remote online pathway, the numbers of TP, FP, TN and FN patients.

8.3.1 Base Case Scenario & Results – OCCP

The results for the OCCP base case scenario outlined in section 8.2 are summarised in table 8.12. In respect of the integration of the OCCP into a GUM pathway compared with an existing GUM pathway, the results demonstrate that 75 fewer patients take up treatment via the OCCP (3,735 GUM compared with 3,659 GUM-OCCP); however, the cost of treatment delivery via OCCP-GUM is £62,710 cheaper.

This reduction in treatment uptake by index patients on the GUM-OCCP pathway translates into a corresponding increase in health complications arising from chlamydial infection, with nine additional complications occurring at an additional cost of £12,935. The similarity in uptake rate between the NCSP and NCSP-OCCP means that the numbers of index patients taking up treatment and health complications are the same, however the delivery of the treatment element of the pathway via the OCCP demonstrated a £28,809 cost saving.

	GUM	OCCP – GUM	Difference	NCSP	OCCP – NCSP	Difference
Total Index Testing Cost	n/a	n/a	n/a	n/a	n/a	n/a
Total Index Patient Uptake (TP & FP)	3,735	3,659	-75	3,354	3,358	4
Total Index Treatment Cost	£128,066	£65,356	-£62,710	£88,774	£59,966	-£28,809
Total Health Complications – Index	47	56	9	93	93	0
Total Cost of Health Complications – Index	£65,275	£78,209	£12,935	£130,595	£129,949	-£647
Total Sex Partners Notified (TP & FP)	5,453	11,161	5,708	3,957	9,401	5,444
Total Sex Partners Treated	2,999	4,241	1,242	2,293	3,572	1,280
Total Cost of Sex Partner Treatment	£102,837	£75,748	-£27,090	£60,690	£63,804	£3,114
Total Health Complications – Sex Partners	199	550	352	135	464	328
Total Cost of Health Complications – Sex Partners	£278,733	£772,192	£493,459	£190,054	£650,432	£460,377
Average Cost per TP index Patient excl Health Complications	£86.22	£53.80	-£32	£62.18	£51.43	-£11
Average Cost per Positive (TP&FP) Patient excl Health Complications	£61.82	£38.56	-£23	£44.57	£36.86	-£8

Table 8.12 - Results for the OCCP compared with GUM and NCSP pathways for the management of chlamydia positive patients

The most notable differences between the pathways can be seen at the sex partner notification and treatment stage. The index notification rate for partners was significantly higher in the OCCP (3.05 partners per index patient identified by GUM patients treated via the OCCP and 2.8 partners per index for NCSP patients treated via the OCCP) compared with the comparator pathways (1.46 partners per index via a GUM clinic and 1.18 partners per index via the NCSP). This increased rate of partners identified per index was a positive benefit of the OCCP compared with existing pathways. However, the partner treatment uptake rate was lower, with 38% of the partners identified by patients treated via the OCCP being treated compared with 55% of GUM clinic partners and 58% of NCSP partners. Although results in table 8.12 demonstrated a larger number of partners treated via the OCCP owing to the larger number of partners identified (over 1,200 more than either the GUM or NCSP comparator pathways), the OCCP results in a much higher number of sex partner health complications (352 more complications for sex partners of index patients treated via the GUM-OCCP rather than GUM clinic and 328 more complications for sex partners of index patients treated via the NCSP-OCCP rather than NCSP treatment routes), and consequently results in greater costs for the treatment of complications.

8.3.2 Sensitivity Analyses – OCCP

The base case analysis presented in the previous section identified a number of parameters within the model which have a material impact on both costs and health outcomes:

- Index treatment uptake,
- Sex partner notification rate,
- Sex partner treatment uptake rate.

There is high uncertainty within these as they are driven by personal choice and potentially could be improved upon with modifications to pathways. The values considered in the sensitivity analysis were based on the OCCP achieving the value achieved by the comparator pathway, and an incremental scale of values in between. One-way sensitivity analysis on these parameters within the OCCP pathway demonstrated the impact of the key measures as follows:

8.3.2.1 Impact of Index (TP & FP) Uptake Rate

Table 8.13 outlines the impact of the OCCP achieving the same or better index (TP & FP) treatment uptake rate:

	% Uptake	Total Index Uptake (TP & FP)	Total Cost £	Total Major Outcomes – Index	Cost of Health Complications – Index £
GUM Base Case	99%	3,735	230,904	47	65,275
GUM-OCCP Base Case	97%	3,659	141,104	56	78,209
GUM-OCCP 100% Uptake	100%	3,773	145,468	42	58,807
GUM-OCCP 99% Uptake	99%	3,735	144,013	47	65,275
NCSP Base Case	89%	3,354	88,774	93	130,595
NCSP-OCCP Base Case	89%	3,358	59,966	93	129,949
NCSP-OCCP 100% Uptake	100%	3,773	139,067	42	58,807
NCSP-OCCP 95% Uptake	95%	3,584	132,114	65	91,144

Table 8.13 – Sensitivity Analysis - Impact of Index Treatment Uptake Rate

Achieving the same levels of uptake as the GUM clinic in the GUM OCCP would result in the same number of major outcomes and associated cost, but at a reduced cost £144,013 via the OCCP compared with £230,904 via the existing GUM clinic pathway.

Within the NCSP internet testing pathway the uptake rates were within 0.01% of each other therefore both are comparable in respect of health complications. However, the cost of treatment delivery via the OCCP is lower compared with the cost of treatment delivered via the current NCSP treatment options of internet testing patients.

8.3.2.2 Sex Partners Identified per Index Patient

Table 8.14 summarises the impact of sex partners identified per index patient. Recognising the OCCP achieved a notably higher number of sex partners identified per index patient, consideration was given to the impact of a lower level of identification within this pathway, given that in comparator pathways a lower identification rate was achieved from the same patient cohort.

	Rate per Index	Total Sex Partners Treated (TP & FP)	Total Cost £	Total Major Outcomes - Sex Partner	Cost of Health Complications - Sex Partner £
GUM Base Case	1.46	2,999	102,837	199	278,733
GUM-OCCP Base Case	3.05	4,241	75,748	550	772,192
GUM-OCCP 2.5 partners notified per index	2.50	3,476	62,088	451	632,944
GUM-OCCP 2 partners notified per index	2.00	2,781	49,671	361	506,355
GUM-OCCP 1.5 partners notified per index	1.50	2,086	37,253	271	379,766
GUM-OCCP 1.46 partners notified per index	1.46	2,030	36,260	264	369,639
NCSP Base Case	1.18	2,293	60,690	135	190,054
NCSP-OCCP Base Case	2.80	3,572	63,804	464	650,432
NCSP-OCCP 2.5 partners notified per index	2.50	3,190	56,968	414	580,742
NCSP-OCCP 2 partners notified per index	2.00	2,552	45,574	331	464,594
NCSP-OCCP 1.5 partners notified per index	1.50	1,914	34,181	248	348,445
NCSP-OCCP 1.18 partners notified per index	1.18	1,506	26,889	195	274,110

Table 8.14 – Sensitivity Analysis - Impact of Sex Partner Identification Rate

The sensitivity analysis of this partner identification rate illustrates that the total number of major outcomes for the OCCP remains above that of the GUM or NCSP comparator pathways, therefore the only other parameter with a direct impact on this is the number of sex partners taking up treatment.

8.3.2.3 Sex Partners (TP & FP) Taking up Treatment

Table 8.15 shows the impact of the percentage of sex partners taking up treatment, with the rate of sex partners identified per index as per the base case. The values were selected to test the impact of achieving an incremental improvement from the value in the OCCP base case through to the value in the comparator base case:

	% Partner Treatment Uptake	Total Sex Partner Uptake (TP & FP)	Total Cost £	Total Major Outcomes - Sex Partner	Cost of Health Complications - Sex Partner £
GUM Base Case	55%	2,999	102,837	199	278,733
GUM-OCCP Base Case	38%	4,241	75,748	550	772,192
GUM-OCCP 60% partner uptake	60%	6,697	119,602	364	511,207
GUM-OCCP 55% partner uptake	55%	6,139	109,635	407	570,522
GUM-OCCP 50% partner uptake	50%	5,581	99,668	449	629,836
GUM-OCCP 45% partner uptake	45%	5,022	89,701	491	689,151
GUM-OCCP 40% partner uptake	40%	4,464	79,734	534	748,466
NCSP Base Case	58%	2,293	60,690	135	190,054
NCSP-OCCP Base Case	38%	3,572	63,804	464	650,432
NCSP-OCCP 60% partner uptake	60%	5,641	100,743	307	430,599
NCSP-OCCP 58% partner uptake	58%	5,453	97,385	321	450,584
NCSP-OCCP 55% partner uptake	55%	5,171	92,347	343	480,561
NCSP-OCCP 50% partner uptake	50%	4,701	83,952	378	530,523
NCSP-OCCP 45% partner uptake	45%	4,231	75,557	414	580,485
NCSP-OCCP 40% partner uptake	40%	3,760	67,162	449	630,447

Table 8.15 – Sensitivity Analysis – Impact of Sex Partner Treatment Uptake

This sensitivity analysis demonstrated that regardless of increasing the uptake rate to reach the base case value for the comparator pathways, the total number of health complications remains higher within the OCCP pathways. This reflects the interdependency between both sex partner identification rate and sex partner treatment uptake rate in avoiding health complications and the costs associated with them.

8.3.2.4 Sex Partners (TP & FP) Taking up Treatment (rate per index as per comparator pathway)

To explore the link further between sex partner identification rate and sex partner treatment uptake rate, sensitivity analysis was undertaken on treatment uptake rate using the same value for identification rate as the comparator pathways. The results are presented in table 8.16.

	% Partner Treatment Uptake	Total Sex Partner Uptake (TP & FP)	Total Cost £	Total Major Outcomes - Sex Partner	Cost of Health Complications - Sex Partner £
GUM Base Case	55%	2,999	102,837	199	278,733
GUM -OCCP Base Case	38%	2,030	36,260	264	369,639
GUM-OCCP	60%	3,206	57,252	174	244,709
GUM-OCCP	55%	2,938	52,481	195	273,102
GUM-OCCP	50%	2,671	47,710	215	301,495
GUM-OCCP	45%	2,404	42,939	235	329,889
GUM-OCCP	40%	2,137	38,168	255	358,282
NCSP Base Case	58%	2,293	60,690	135	190,054
NCSP-OCCP Base Case	38%	1,506	26,889	195	274,110
NCSP-OCCP	60%	2,377	42,456	129	181,467
NCSP-OCCP	58%	2,298	41,041	135	189,889
NCSP-OCCP	55%	2,179	38,918	144	202,522
NCSP-OCCP	50%	1,981	35,380	159	223,578
NCSP-OCCP	45%	1,783	31,842	174	244,633
NCSP-OCCP	40%	1,585	28,304	189	265,688

Table 8.16 – Sensitivity Analysis – Sex Partner Treatment Uptake with Sex Partner Identification rate at comparator pathway rate (GUM – 1.46 partners per index, NCSP – 1.18 partners per index)

This analysis demonstrated that where these parameters are the same as the comparator pathway, the parameter influencing the number of partners treated is the index uptake rate i.e. fewer index patients treated leads to fewer partners treated where the parameters relating to partners are constant.

8.3.3 Base Case Scenario & Results – Fully Remote Online Pathway

This section presents the findings relating to the fully remote online pathway from self-test to partner treatment and health advisor follow up. Table 8.17 outlines the results of the key outcome measures for a theoretical cohort of 100,000 people. Having evaluated and reported on the base case parameters and sensitivity analysis for the OCCP in the previous sections, the key parameters where variance could impact on outcomes and cost at the testing stage are test cost and test performance characteristics (sensitivity and specificity). Within the base case, the test characteristics are the same across all three pathways as the self-test for the fully remote online pathway has not yet been developed, therefore the only variance in the test parameters between the pathways is test cost.

	GUM	NCSP	Online	Difference Online - GUM	Difference Online - NCSP
Total Index Testing Cost	£12,900,000	£2,269,000	£2,129,000	-£10,771,000	-£140,000
Total Index Patient Treatment Uptake (TP & FP)	3,735	3,354	3,358	-377	4
Total Index Treatment Cost	£92,511	£83,610	£56,709	-£35,802	-£26,901
Total Index Testing & Treatment Cost	£13,066,797	£2,409,768	£2,246,047	-£10,820,750	-£163,721
Total Health Complications – Index	47	93	93	46	0
Total Cost of Health Complications – Index	£62,275	£130,595	£129,949	£64,674	-£647
Total Sex Partners Notified (TP & FP)	5,453	3,957	9,401	3,948	5,444
Total Sex Partners Treated	2,999	2,293	3,572	573	1,280
Total Cost of Sex Partner Treatment	£74,286	£57,159	£60,338	-£13,948	£3,180
Total Health Complications – Sex Partners	199	135	464	265	328
Total Cost of Health Complications – Sex Partners	£278,733	£190,054	£650,432	£371,698	£460,377
Average Cost per TP index Patient excl Health Complications	£1,771	£1,002	£933	-£3,948	-£69
Average Cost per Positive (TP&FP) Patient excl Health Complications	£3,499	£719	£669	-£2,830	-£50

Table 8.17 – Fully Remote Online Pathway Base Case Scenario Results

It can be seen that the cost of testing is notably higher in GUM. It is important to recognise that the reference cost for a first outpatient attendance in GUM is derived from the aggregate costs associated with all GUM activity, and as highlighted in section 2.4.4; the management of asymptomatic patients in GUM sees patients routinely tested for gonorrhoea, HIV and syphilis in addition to chlamydia.

8.3.4 Sensitivity Analysis – Fully Remote Online Pathway

As noted in the previous section, the two parameters which influence cost and health outcomes at the testing stage are test performance characteristics and test cost.

8.3.4.1 Test Performance Characteristics

In the base case scenario for all three pathways the BD ProbeTec test performance characteristics were adopted as this is the test identified in operation at one of the sites within the OCCP exploratory study. Four tests are recognised within the BASHH testing guidelines for chlamydia as commonly used in clinical practice in the UK (BASHH, 2010). These are summarised further in table 8.18, along with a fifth test which was recently approved by the FDA (2013), and is currently subject to service evaluations within the NHS, the Xpert CT/NG assay (FDA, 2013).

Test Assay	Sensitivity	Specificity	TP	FP	TN	FN	PPV
BD ProbeTec CT Q^{x} Amplified DNA Assay (FDA, 2008b)	94.50%	98.90%	2,704	1,069	96,070	157	72%
Abbott RealTime CT/NG Assay (FDA, 2006)	94.97%	99.17%	2,718	806	96,332	144	77%
Aptima CT Assay (FDA, 2008a)	96.83%	96.35%	2,771	3,546	93,593	91	44%
Cobas Amplicor CT/ NG Test (FDA, 1998)	93.06%	97.86%	2,663	2,079	95,060	199	56%
Xpert CT/NG Assay (FDA, 2013)	96.35%	99.57%	2,757	418	96,721	104	87%

Table 8.18 - Test Performance Characteristics for Commonly Used Chlamydia Tests in the UK

Key – TP – True Positive, FP – False Positive, TN – True Negative, FN – False Negative, PPV – Positive Predictive Value

The PPV has been derived using the prevalence rate used in the model from NATSAL3 (a general population sample) of 2.3% for males and 3.1% for females (Sonnenberg et al., 2013). The PPV is considerably lower than the minimum standard set by BASHH for chlamydia screening tests of 90% (BASHH, 2010).

The MTEP methods guide highlights that a recommendation for adoption within the NHS is usually made when it is considered that:

- "there is sufficient certainty that the technology produces at least equivalent clinical and/or health system benefits compared with current management options and with a net reduction in resources required; **or**
- there is sufficient certainty that the technology produces significantly greater clinical and/or healthcare system benefits compared with current management options for similar investment of resources" (NICE, 2011b:21).

Hence, there is no basis to consider test performance characteristics below those identified for the current range of acceptable test. It was therefore decided to use the characteristics for Xpert to include in the sensitivity analysis for the eSTI^2 self-test in the absence of actual self-test performance characteristics, the results are summarised in table 8.19. The first important point to note is the increase in the identification of true positive (53) and reduction in the number of false positive (651) patients diagnosed with chlamydia. This is particularly significant given the costs incurred in the treatment of index and sex partners with a false positive result.

	GUM	NCSP	Online	Difference Online - GUM	Difference Online - NCSP
Number of True Positive Results	2,704	2,704	2,757	53	53
Number of False Negative Results	157	157	104	-53	-53
Number of True Negative Results	96,070	96,070	96,721	651	651
Number of False Positive Results	1,069	1,069	418	-651	-651
True Positive Index Treatment Uptake	2,150	1,643	2,561	411	918
Total Index Testing Cost	£12,900,000	£2,269,000	£2,129,000	-£10,771,000	-£140,000
Total Index Patient Treatment Uptake (TP & FP)	3,735	3,354	2,825	-909	-528
Total Index Treatment Cost	£92,511	£83,610	£47,721	-£44,790	-£35,888
Total Index Testing & Treatment Cost	£13,066,797	£2,409,768	£2,227,497	-£10,839,300	-£182,271
Total Health Complications – Index	47	93	85	38	-8
Total Cost of Health Complications – Index	£62,275	£130,595	£118,680	£53,400	-£11,915
Total Sex Partners Notified (TP & FP)	5,453	3,957	7,911	2,458	3,954
Total Sex Partners Treated	2,999	2,293	3006	7	713
Total Cost of Sex Partner Treatment	£74,286	£57,159	£50,776	-£23,511	-£6,383
Total Health Complications – Sex Partners	199	135	473	274	337
Total Cost of Health Complications – Sex Partners	£278,733	£190,054	£663,165	£384,432	£473,111
Average Cost per TP index Patient excl Health Complications	£4,881	£1,002	£908	-£3,973	-£95
Average Cost per Positive (TP&FP) Patient excl Health Complications	£3,499	£719	£718	-£2,710	£70

Table 8.19 - Sensitivity Analysis - Test Performance Characteristics

8.3.4.2 GUM Cost

As outlined in section 8.3.3 the costs associated with testing are notably higher in the GUM clinic than the NCSP pathway. This is in part due to the delivery of testing within a clinic setting and the wider range of activities undertaken in a GUM setting beyond chlamydia testing. Adams and colleagues undertook pathway mapping on a GUM clinic pathway as part of their consideration of the implementation of POCT NAATs within GUM clinics for chlamydia and gonorrhoea (Adams et al., 2014). They identified a cost of £45.34 for chlamydia testing only within GUM, which when uplifted to 2014/15 prices was £45.75. Using this value as the testing cost within GUM (recognising the self-test cost is currently the lowest) identified that despite the impact of higher index and partner treatment rates in GUM compared with the fully remote online pathway, reducing the cost of GUM testing to the value identified by Adams and colleagues did not reduce the average cost per patient to below that of the fully remote online pathway. The results are summarised in table 8.20.

	GUM	NCSP	Online	Difference Online - GUM	Difference Online- NCSP
Total Index Testing Cost	£4,575,000	£2,269,000	£2,129,000	-£2,446,000	-£140,000
Total Index Patient Treatment Uptake (TP & FP)	3,735	3,354	3,358	-377	4
Total Index Treatment Cost	£92,511	£83,610	£56,709	-£35,802	-£26,901
Total Index Testing & Treatment Cost	£4,741,797	£2,409,768	£2,246,047	-£2,495,750	-£163,721
Total Health Complications – Index	47	93	93	46	0
Total Cost of Health Complications – Index	£62,275	£130,595	£129,949	£64,674	-£647
Total Sex Partners Notified (TP & FP)	5,453	3,957	9,401	3,948	5,444
Total Sex Partners Treated	2,999	2,293	3,572	573	1,280
Total Cost of Sex Partner Treatment	£74,286	£57,159	£60,338	-£13,948	£3,180
Total Health Complications – Sex Partners	199	135	464	265	328
Total Cost of Health Complications – Sex Partners	£278,733	£190,054	£650,432	£371,698	£460,377
Average Cost per TP index Patient excl Health Complications	£1,771	£1,002	£933	-£838	-£69
Average Cost per Positive (TP&FP) Patient excl Health Complications	£1,270	£719	£669	-£601	-£50

Table 8.20 - Sensitivity Analysis - Base Case Parameters with Reduced GUM Cost

8.3.5 Applying the DCE Findings to the Economic Evaluation

The findings from the DCE presented in Chapter 6 provide insight into potential uptake of chlamydia testing and treatment pathways. This section explores the application of this data within the economic model to assess the total costs and wider impact of implementing the OCCP as a treatment option alongside GUM and NCSP, and the fully remote online pathway as a testing and treatment option alongside GUM and NCSP.

Coefficients presented in section 6.5.3 have been used to derive the probability of uptake for the current options considered (GUM and NCSP internet testing), and the introduction of either OCCP (for treatment and partner notification), or the fully remote online pathway (testing, treatment and partner notification) alongside the two current pathway options considered. The results, based on the application of the probability of uptake from the DCE to the theoretical cohort of 100,000 people testing using the model base case parameters, are presented in tables 8.21-8.23.

These results demonstrate that introducing the OCCP into mainstream practice alongside current pathways results in fewer index patients treated overall but more sex partners treated for a lower cost. A similar results pattern is demonstrated for the fully remote online pathway. If the fully remote online pathway were optimised to achieve higher test accuracy and a comparable level of partner treatment uptake then fewer index patients are treated resulting from the reduction in false positives for less cost, and a significantly larger cohort of partners treated (with an associated increase in cost); however, there are still a larger number of health complications arising for sex partners. This is due to the considerably higher sex partner notification rate associated with the OCCP.

	Current Pathways Total Activity	Current Pathways Total Cost £	Introducing OCCP alongside current Total Activity	Introducing OCCP alongside current Total Cost £	Difference - Activity	Difference - Cost £
Number of positive index patients (TP & FP) taking up treatment	3,525	87,615	3,465	76,611	-61	-11,004
Total health complications (index)	127	178,811	135	189,216	7	10,404
Number of sex partners of positive index patients (TP & FP) notified	4,630	-	6,321	-	1,690	-
Number of sex partners (TP & FP) taking up treatment	2,611	64,866	2,950	63,207	340	-1,659
Total health complications (sex partners)	164	229,960	270	379,049	106	149,089

Table 8.21 - The impact of introducing OCCP alongside GUM and NCSP treatment options, base case scenarios

	Current Pathways Total Activity	Current Pathways Total Cost £	Introducing Online Total Activity	Introducing Online Total Cost £	Difference - Activity	Difference - Cost £
Total Cost of Testing	-	6,627,710	-	3,885,960	-	-2,741,750
Number of positive index patients (TP & FP) taking up treatment	2,516	62,544	2,449	49,380	-67	-13,164
Total health complications (index)	74	103,814	85	119,756	11	15,942
Number of sex partners of positive index patients (TP & FP) notified	3,276	-	5,349	-	2,073	-
Number of sex partners (TP & FP) taking up treatment	1,850	45,992	2,275	44,297	424	-1,695
Total health complications (sex partners)	161	226,413	343	480,469	181	254,057

Table 8.22 - The impact of introducing a fully remote online pathway alongside GUM and NCSP testing and treatment options, base case scenarios

	Current Pathways Total Activity	Current Pathways Total Cost £	Optimised Online Total Activity	Optimised Online Total Cost £	Difference - Activity	Difference - Cost £
Total Cost of Testing	-	6,627,710	-	2,903,617	-	-3,724,093
Number of positive index patients (TP & FP) taking up treatment	2,516	62,544	2,425	44,443	-90	-18,102
Total health complications (index)	74	103,814	89	125,451	15	21,637
Number of sex partners of positive index patients (TP & FP) notified	3,276	-	8,562	-	5,286	-
Number of sex partners (TP & FP) taking up treatment	1,850	45,992	4,954	87,243	3,104	41,251
Total health complications (sex partners)	161	226,413	293	411,640	132	185,228

Table 8.23 -The impact of introducing a fully remote online pathway alongside GUM and NCSP testing and treatment options, fully remote online pathway optimised for test sensitivity and specificity and sex partner treatment uptake

8.4 Discussion

The results outlined in section 8.3 demonstrate that the OCCP is cost-saving for the service delivery phase when compared as a standalone with existing pathways and also when integrated into a delivery model alongside mainstream sexual health services. The exploratory study indicated that an OCCP is broadly comparable with existing pathways for treatment uptake and far exceeds existing pathways in respect of the number of partners identified per index patient. However, is significantly below existing pathways in respect of the percentage of identified partners who are treated. The consequence of this is likely to be a significantly larger number of health complications for untreated partners.

Recognising the need to achieve parity with existing pathways in respect of clinical and/ or system benefits to receive a positive endorsement by the NICE MTEP (NICE, 2011) there are two important factors which need to be considered. Firstly, the rate of sex partners identified per index. The data for this has been gathered from small numbers participating in an exploratory study and no comparable published data on this type of online treatment pathway could be identified. However, the exploratory study participants have been sourced from an existing population who have chosen to test at either a GUM clinic or via the NCSP internet testing pathway. Therefore, it is unlikely that their number of partners over the previous six months would be that different to those receiving treatment via these routes.

There is a recognised evidence base to support the belief that people are more honest in providing information via computer aided self-interview (CASI) technology within sexual health services. For example, Richens and colleagues used CASI for history taking in a randomised control trial undertaken in sexual health clinics and found that it "demonstrated greater capture of sensitive information during computer assisted interviews and attributed this to a reduction in social desirability bias" (Richens et al., 2010:313), and Tideman and colleagues found in an RCT of CASI that "women undertaking the CASI reported a significantly higher median number of male partners for the preceding 12 months" (Tideman et al., 2007:52).

This lends credence to the argument that the online nature of the OCCP has led to more honest responses from index patients than those in face-to-face situations. This would be viewed as a benefit from a public health perspective if the identification of additional partners converts into partner treatment and reduced transmission. This view is supported by Turner and colleagues who explored strategies to improve the cost-effectiveness of chlamydia screening and identified that "there is considerable scope to improve partner notification outcomes. Furthermore, reallocation of resources to ensure provision and monitoring of effective partner notification is likely to result in substantial cost savings in comparison with increasing screening coverage only" (Turner et al., 2011:5).

Secondly, the number of health complications and associated costs arising from untreated chlamydial infection. As previously outlined in sections 3.5.1 and 8.2.3.3, evidence on both the probability of health complications and their associated cost is limited. Price and colleagues highlight that the evidence base for the NCSP has been repeatedly called into question "with little consensus on modelling assumptions, parameter values or evidence sources to be used in cost-effectiveness analyses" (Price et al., 2016:v) and Ong and colleagues acknowledge that "readers must be satisfied that the chlamydia-related sequelae considered, and their management cost estimates used in the analyses sufficiently reflect the perspective taken by authors of economic evaluations, as well as being suitable for the reader's individual context" (Ong et al., 2016:6).

In considering the health complications included in the model, the range of complications was limited to those where evidence was identified from existing models and new systematic reviews. In respect of the costs these were derived from UK studies/ guidelines only, to avoid the impact of variation in international health systems, delivery models and associated costs. However, despite this, there is still a considerable range in the costs of treatment of health complications identified as outlined in table 8.10. Whilst sensitivity analysis could be used to vary the cost or disease likelihood parameters, these would vary consistently across all three pathways. Therefore, the only way that they could have a direct impact on the total costs in the model is if they were reduced to such an extent that the costs of treating health complications are offset by savings in the delivery of testing and treatment. This analysis has not been undertaken as it does not support the MTEP approach of achieving equivalence with existing pathways nor is it a realistic likelihood.

Therefore, the key to demonstrating equivalence or better lies with the model parameters which lead to an overall reduction in health complications namely index treatment uptake, partner identification per index and partner treatment uptake. The DCE data allowed for the modelling to incorporate likely patient choice and the impact of that on costs and outcomes, in particular, seeing how a higher test accuracy would hypothetically move patients between services and the impact that would have on costs and outcomes.

Considering the strengths of this research, a transparent model, with a highly detailed decision tree was constructed with the opportunity to enable variation and further granularity in the pathway as the technology develops. It has demonstrated that it can provide a clear understanding for users (e.g. technology developers), of the impact of a range of parameters on cost and outcomes in the form of total numbers of patients treated and health complications.

The model built on previous research and used pathways mapped as part of the costing study as well as the most recently published data to enable comparison with current practice. It highlights key areas for further research and development of the OCCP and fully remote online pathway to optimise both clinical and cost-effectiveness. The model also uses data on preferences derived from the DCE to inform likely uptake should all three pathways be available, to consider the cost of all pathways within a health system as well as enabling comparison between the costs and outcomes of individual pathways.

The limitations of this research can be grouped under two headings: model parameters, and service configurations and developments. Whilst parameters have been sourced through a systematic process of literature reviews and primary data collection as part of the OCCP exploratory study there are a number of limitations associated with this. As highlighted previously, only a small population participated in the exploratory study. Process measure data was not collected for the comparator pathways alongside the OCCP therefore this data was sourced from published data. In many cases the published data is based on clinical audits which may be subject to bias because of the audit process. In the case of GUM in particular, data was published a number of years ago, meaning that it may not be reflective of e.g. the number of partners identified per index, compared with the number of partners reported today.

The absence of a self-test on the market has meant that there are no test parameters for a NAAT self-test that can be entered into the model. The improved test parameters reported for the Cepheid GeneXpert test demonstrate the impact of a test with better diagnostic performance. The Xpert test is a POC NAAT which has a turnaround time of 90 minutes and is an example of another type of technology (POCT) currently under development.

The model considered two comparator pathways from mainstream practice but did not consider other types of technology currently under development which may be available to the health service at the same time/ prior to the availability of the OCCP or a chlamydia NAAT self-test. This is an important factor for the technology developers more so than commissioners or providers of health services, the structure of the model would enable alternative pathways such as POCT to be constructed.

Another relevant area of development is partner treatment with expedited partner therapy (EPT) and accelerated partner therapy (APT) demonstrating preliminary clinical effectiveness and acceptability (Estcourt et al., 2015b). Given the lower rates of partner uptake within the current OCCP exploring such approaches may be an appropriate method of improving partner treatment levels in an OCCP.

Finally, as noted in section 3.5.1, a static model was selected for this research because of the stage of technology development. However, it is acknowledged that the transmission dynamic elements of chlamydia mean that there may be benefits resulting from reducing time to result and time to treatment of both index patients and their partners, although these are both dependent on resolution of the issues relating to uptake.

Comparing the findings of the current economic evaluation to other published studies is challenging. As previously highlighted, there are no other published studies exploring OCCP and self-testing technology for chlamydia. Bracebridge and colleagues have explored the implementation of a postal testing pathway with treatment delivered via an online questionnaire reviewed by a GUM doctor who prescribed treatment. At 2008-09 prices the cost of screening via this pathway was £1,570 per positive patient (excluding set up costs), compared with £506 per positive patient (Bracebridge et al., 2012). This compares with £669 per positive patient tested and treated via the fully remote online pathway and £719 via the NCSP internet testing pathway.

There are some notable differences in the pathways costed. For example, the Bracebridge remote pathway is a population based screening pathway so incurs the costs of sending kits to all 18-24 year olds therefore these costs are included in the value per positive patient whereas the comparator NCSP pathways offer opportunistic screening.

Similarly, Hislop and colleagues explored the adoption EIA POCT in a family planning clinic. They found that current practice is less costly (£384.01 per positive patient tested and treated, compared with £567.70 and £541.23) and more effective (Hislop et al., 2010). However, this research did not consider any variance between elements of pathway change resulting from the introduction of POCT. For example, it might be assumed that there would be a higher treatment uptake rate if people are tested and offered treatment in the same attendance. Turner and colleagues have estimated the cost and outcomes of introducing POCT into GUM clinic settings compared with the traditional GUM pathway. They found that POCT reduced the cost of asymptomatic testing in GUM clinics from £79.77 to £75.50 per person. It was also theoretically more effective with a small increase in QALYs, reduction in health complications arising from untreated chlamydia and onward transmission (Turner et al., 2014). Finally, Turner and colleagues also undertook mathematical modelling to explore what changes to chlamydia screening might make it more clinically and cost effective. Compared to the 2008-09 screening cost of £506 per infection treated, they identified that increased uptake of partner treatment from 0.4 to 0.8 partners per index would reduce this to £449 per infection treated whilst increasing male screening uptake from 8% to 24% would increase this cost to £528. Their findings in respect of partner treatment are consistent with the findings of the present research.

Generalisability of the present research findings is limited owing to variations in practice at local level. Such variation can be evidenced in a number of sources including NCSP clinical audits (Public Health England, 2014a, Public Health England, 2016a), PHE annual STI data (Public Health England, 2016b) as well as the costing study undertaken as part of this research. Local variations in delivery and the impact on costs also featured in a National Audit Office report which found that the local commissioning approach employed by the NCSP led to "duplication of effort and cost in several aspects of the programme which have been purchased in a fragmented way by multiple local commissioners" (National Audit Office, 2009:9). Whilst the commissioning organisations featured in the report no longer exist, the transfer of commissioning responsibility to local authorities in 2013 may have replicated the organisational circumstances leading to this inefficiency. One benefit of the model created in the present study is that it can be adapted for use with local parameters to assess the impact at a local level, if necessary. However, further research into the variability of local pathways would be beneficial owing to the undisputable impact on costs of service delivery identified in Chapter 7.

This research has also highlighted a number of other areas where further research would be beneficial prior to the adoption of an OCCP or fully remote online pathway. Firstly, research to explore how the new technology can achieve index and partner uptake rates comparable with existing pathways. Secondly, further exploration of increased partner identification. Whilst potentially a significant benefit, consideration as to how to manage the differential impact within the modelling is required. Within the model, only two pathways are selected for comparison with the OCCP and fully remote online pathway. However, there are other ways of accessing chlamydia testing and treatment services as outlined in figure 2.1.

Further research would be beneficial to understand how these two new pathways might impact on or interface with other routes to accessing chlamydia testing and treatment.

The ECDC literature review into Chlamydia control published in 2014 recognised the limitations and gaps in knowledge from both a disease and cost perspective (ECDC, 2014). Research published since then has addressed these gaps to some extent but still does not reach a conclusive position in respect of the incidence and cost of health complications arising from untreated chlamydia. Price and colleagues recently identified a set of parameters to be used in modelling some of the health complications but highlight the need for further research to validate their findings (Price et al., 2016). Similarly, Ong and colleagues' review of the cost estimates of health complications exposed the considerable differences in parameters within the UK and internationally when it came to considering both the cost of treating complications and the range of complications included in modelling (Ong et al., 2016). Whilst the impact of changes in these parameters was not explored in sensitivity analysis in the current research, it is evident that the variance in these parameters has a material effect on the costs associated with the management of chlamydia. Further research to determine a common set of complications, their incidence and attributable cost in the UK would enable more comparable estimates of the costs and benefits associated with asymptomatic chlamydia testing and treatment.

Another area in which further information would be beneficial is test performance characteristics. Recognising that test accuracy is the attribute most important to young people in choosing to test for chlamydia and the importance of delivery of comparable outcomes in the NICE MTEP approval process any new test would need to deliver a level of performance at least comparable to the existing tests. Notably, in table 8.18 a PPV of below 90% is seen for all tests at the general population prevalence rate identified in NATSAL-3 (Sonnenberg et al., 2013). Given the desire to increase uptake across the general population, it is questionable whether clinic positivity rates are still the best measure to be used in assessing test performance. A better measure might be prevalence estimates in the general population. This should be considered as part of new test development programmes.

Finally, value of information analysis techniques, e.g. expected value of perfect information (EVPI) were not considered in this research. EVPI can be defined as the cost associated with removing all uncertainty from the model, thus removing the possibility of making the wrong decision (Briggs et al., 2006). The purpose of the model was to demonstrate the likely impact on costs and outcomes, therefore it was considered not appropriate to undertake this analysis within the context of the current stage of technology development. Further research may be beneficial to explore the optimum point within the product development pathway to undertake this analysis.

8.5 Summary

The decision analytic model presented in this chapter demonstrated the impact of moving beyond the costs and outcomes associated with short-term service delivery to include the consideration of the impact of the intermediate/ process outcomes on long term health outcomes in the form of complications arising from untreated chlamydia. The results have shown that the parameters associated with number of partners notified per index, and partner treatment rate have the most significant influence on the costs and outcomes associated with the OCCP and fully remote online pathway.

Utilising the DCE coefficients to model the impact of introducing the fully remote online pathway alongside existing pathways has demonstrated that, based on uptake calculated from the DCE results, the overall mix of service delivery is cost saving when the OCCP and/ or fully remote online pathway is introduced. However, overall the number of complications and costs associated with untreated chlamydia increases when the new pathway is added to existing pathways.

The early economic evaluation in this chapter has highlighted the key features of the OCCP and fully remote online pathway which require further research and development in order to deliver eHealth clinics and chlamydia self-tests with outcomes which are at least comparable with existing pathways.

The final chapter reflects on the research presented in the previous seven chapters and considers the learning in respect of the application of methods, the implications for the future delivery of sexual health services and broader issues for the implementation of eHealth and mHealth initiatives within the NHS.

CHAPTER 9 – DISCUSSION AND CONCLUSIONS

9.1 Introduction

This thesis set out to explore the costs and benefits of integrating novel digital technology for the testing and treatment of chlamydia into mainstream sexual health services in England. Two levels of integration of digital technology were considered. The most ambitious was a fully remote online pathway incorporating a self-test and online treatment and partner notification; the second was a partial remote online pathway from results notification onwards (OCCP). The research findings illustrate several fundamental issues which apply to this and potentially other evaluations of eHealth and mHealth initiatives, particularly those which aim to deliver diagnosis and treatment, rather than interventions for behaviour change or long term condition management. This chapter draws together the main research findings from Chapters 4 to 8, reflects on the research methods used, and presents the key conclusions and recommendations for future research.

9.2 Summary of Main Research Findings

9.2.1 Literature Reviews & Focus Groups

The literature reviews presented in Chapter 4 identified the research undertaken to date to understand which factors might influence individuals' decisions to access testing and treatment services for STIs in OECD high income countries. The OCCP and fully remote online pathway technologies explored in this thesis have the potential to overcome many of the barriers identified in the literature for the uptake of STI testing and treatment services, and address a gap in knowledge in respect of preferences for aspects of OCCP and fully remote online pathways.

The findings from the focus groups with young people presented in Chapter 5 supported this view. *Time from test to result* (time to result) was the aspect which featured most frequently in the focus group discussions with a general consensus in all four groups that quicker results were preferred, with *worry and anxiety about the outcome of the test* being the main reason for this preference. This was followed by *test accuracy* being drawn out by participants themselves as an important consideration.

The questions raised by focus group participants demonstrated a general lack of understanding about the accuracy of currently available tests in clinical practice. The desire for a broader *range of tests*, that is testing for multiple STIs, was another important consideration highlighted by the focus groups with a general view expressed that the more STIs they are tested for the better.

9.2.2 Discrete Choice Experiment

The focus group findings were reflected in the DCE findings presented in Chapter 6. The DCE results supported the view that test accuracy and time to result were the strongest attributes influencing young people's preferences for chlamydia testing and treatment pathways. These findings suggest that any new self-tests coming into clinical practice would need to improve upon (or at least equal) the current laboratory or clinic-based test performance characteristics, in terms of both accuracy and time to result. Whilst not as stark in their strength of preference, the other attributes included within the study demonstrate a general preference for remote pathway options including self-testing and self-sampling and posting the sample for analysis over attending a healthcare setting for testing. This is also reflected in treatment preferences, although to a lesser extent in respect of the strength of preference for online consultation methods.

This DCE research was recognised at The Lancet Public Health Science Conference by the NIHR School of Public Health Research who acknowledge that its findings could improve screening uptake and successful treatment of chlamydia in England (Nicholl, 2016).

9.2.3 Economic Evaluation

Whilst the preferences of young people are fundamental for uptake of any STI services, the costs and benefits of the introduction of digital technology must be considered by technology developers and commissioners. Chapter 7 explored the costs and consequences of introducing eHealth clinics (OCCP) for asymptomatic chlamydia treatment. The costing of this eHealth clinic was based on data drawn from the exploratory study undertaken by the eSTI^2 research consortium. The analysis showed the OCCP could be cost saving when compared with GUM and NCSP internet testing pathways. However, the costing study also found considerable variability in the delivery models for current chlamydia pathways from results notification onwards. It is important to note that optimisation of existing pathways could therefore also lead to a reduction in cost of their delivery and thus affect the estimates of savings of the introduction of an eHealth clinic such as the OCCP. The outcome measures identified by the exploratory study to demonstrate the safety and feasibility of remote online care focused on process measures (such as uptake rates and time to treatment) rather than health-related outcomes. This approach demonstrated non-inferiority compared with existing pathways for all indicators other than partner treatment uptake. However, this needs to be considered within the context of recognised issues with accuracy of partner treatment data, for example the accurate capturing of partner notification outcomes.

The findings of the economic evaluation in Chapter 8, based on the costing study, the findings from the OCCP exploratory study and published data, demonstrated the links between the process measures used and health outcomes, i.e. the health complications arising from untreated chlamydia. This highlighted the impact of both the number of partners identified per index and the uptake of partner treatment. Although the cost per case detected for the fully remote online pathway is lower than the comparator pathways (£38.56 per positive patient compared with £61.82 GUM, and £36.86 per positive patient compared with £44.57 NCSP internet testing pathway), and process measures/ health outcomes for index patients (treatment uptake and complications arising from untreated chlamydia) are broadly similar, adding in consideration of partner outcomes demonstrated a significant difference in the number of health complications arising from untreated chlamydia. The combined costs of delivery and treatment for chlamydia health complications are considerably higher for both the OCCP and the fully remote online pathway than the comparator pathways. Presenting costs and outcomes separately for a range of indicators highlights the parameters where further research is required to deliver health-related outcomes (avoidance of complications arising from untreated chlamydia) from the use of the new digital pathways that are at least comparable to existing pathways. For the OCCP the most significant parameter requiring further work is partner treatment uptake. Whilst there is no self-test currently available, this research suggests that the parameter of greatest importance for further work is test accuracy, both in terms of securing process and health outcomes comparable with existing practice, and being a product that young people will use.

The model established for the economic evaluation supports this further research through the ability to vary the parameters, for example, to enable test developers to understand the impact of test performance characteristics and uptake. It can also be used beyond this to understand the impact of the technology pricing.

9.3 Methods Considerations

9.3.1 DCE

The utilisation of qualitative methods with respondents to inform the design and development of a DCE is still relatively uncommon. Coast and colleagues point to the value of qualitative work in the development of attribute and levels highlighting its worth in two stages "conceptual development and the generation of meaningful language" (Coast et al., 2012:739). Whilst there are explicit recommendations regarding the use of qualitative research in the selection of attributes and levels for DCEs (Bridges et al., 2011), there is no explicit recommendation that this qualitative research is undertaken with target respondents. The insight provided in the current research by the focus groups with young people informed many aspects of the DCE including the attributes and levels selected, their phrasing and definition, and the explicit consideration and presentation of information in the questionnaire introduction to reduce the risk of respondents making their own assumptions about a specific aspect of a service e.g. data security, cost. The evidence gathered through the focus groups also enabled the discussions with experts and consideration of policy and service context to be framed through the eyes of the target respondents.

The DCE did not address one of the most important attributes identified by young people in the focus groups which is the *range of STIs* for which they are tested. Currently the only national STI screening programme identified as cost-effective is chlamydia testing in the 16-25 population. It is also recommended men who have sex with men should be tested annually for chlamydia, gonorrhoea, syphilis, HIV, hepatitis B and hepatitis C (BASHH, 2014). There was a clear and justifiable reason for excluding this from the DCE design owing to the variance in the clinical management of different types of STIs and the scope for introduction of new technologies into those pathways.

Linked to this, the need to control a participant's assumptions about which STI they were thinking about whilst completing the DCE was another important consideration in limiting the scope to chlamydia, i.e. their choices may be different if thinking about testing and treatment for different STIs e.g. HIV or chlamydia. However, the impact on uptake of the range of tests is an important consideration for developing future digital technologies for the management of STIs.

Murray and colleagues identify a key question in the evaluation of digital health interventions as being "is the digital health intervention likely to reach this population, and if so, is the population likely to use it?" (Murray et al., 2016:845). A key benefit of the DCE method in assessing preferences is that it identifies the strength of preference for attributes, in this case providing information which should enable further refinement of the existing OCCP or a future fully remote online pathway to maximise uptake.

The use of a mixed methods approach incorporating qualitative research with the respondent group, and evidence synthesis informed by published literature and expert opinion, to inform the attribute selection and DCE design provided the opportunity to maximise the relevance of the study outcomes to inform the design of new technologies and new pathways for the testing and treatment of chlamydia. Although eHTA/ HTA frameworks acknowledge acceptability and patient preferences within them, the clinical and cost-effectiveness of interventions are the primary considerations in most, especially when HTA is undertaken for drugs and devices where uptake is driven primarily by clinicians. In public health interventions, such as screening, further consideration is required of acceptability for evaluation of digital health interventions, given that the general population have a significantly greater role to play in uptake and therefore cost-effectiveness. This is particularly relevant for digital health interventions for sexual health services where uptake is a significant factor in screening programme cost-effectiveness.

9.3.2 Economic Evaluation

On commencement of this research in 2013 there was little published in respect of the methods for the evaluation of eHealth and mHealth interventions, particularly in the early stage of their development and this remains the case in 2016. Undertaking the economic evaluation within an eHTA framework provided structure for considering the likely costs and benefits of the OCCP or a fully remote online pathway. However, these methods were primarily developed for drugs and devices, and are not optimal for eHealth interventions owing to the pace of the base technology development e.g. smartphones, smartphone consumables and apps/ software, the lack of experience with adoption and the lack of tools to measure outcomes.

This was acknowledged in a recent publication as being one of the limiting factors for amassing an evidence base for eHealth interventions (Murray et al., 2016). This paper also identified a series of key research questions for evaluating a digital health intervention which broadly align to the domains of HTA, drawing out specific issues for the evaluation of this type of technology (ibid.).

However, this approach focuses on the use of digital health interventions for behaviour change, long-term condition management and non-drug based treatment. Whilst these are a helpful reference point, there are specific considerations for digital technologies when used for the testing and treatment of 'acute' medical conditions. For self-testing this includes the behaviour of the individual following a test result (Ickenroth et al., 2010) and for treatment this includes the management of patients who need to 'drop off' the online pathway and return to mainstream services (Gibbs et al., 2016), particularly for the evaluation of the safety and efficacy of the intervention.

There is still little published on the methodological considerations for the costing of eHealth interventions. The key issues identified by Tate and colleagues in 2009 were reflected in a recent publication by McNamee and colleagues, but without any clear recommendations on a preferred approach (Tate et al., 2009, McNamee et al., 2016). Achieving consistency in key elements of the costing of digital interventions is important, particularly for enabling the comparison of costs between different initiatives. Similarly, there is currently no published guidance on how the economic evaluation of digital health interventions should be undertaken (McNamee et al., 2016).

This is not unique to eHealth and mHealth, similar issues and challenges were associated with the economic evaluation of telemedicine in the early stages of its implementation (McIntosh and Cairns, 1997).

9.4 Areas for Future Research

If the fully remote online pathway or OCCP were adopted into mainstream sexual health services in England there are a number of aspects that the research presented in this thesis cannot account for, namely the likely wider impact of introduction of fully remote digital pathways. For example, whilst the DCE suggests a higher probability of uptake when offered alongside the comparator options, it is unclear whether as well as more people take up testing, these will be the population at higher risk as opposed to the 'worried well' and whether there will be an increase in repeat testing. It is also uncertain whether increased availability and accessibility to online testing and treatment might lead to people taking more risks in respect of STIs negating the benefits of increased test uptake. Therefore, an evaluation of the impact on health behaviour is another important consideration in future research.

As noted earlier, sexual health is an area which is already experiencing numerous simultaneous technological advances. For example, the extension of online ordering to include a wider range of STI test kits for self-sampling (Wilson et al., 2016), further developments to POCT to include low cost handheld devices (Mackay et al., 2015), and the exploration of APT for improving partner notification and treatment uptake (Althaus et al. 2014, Roberts et al., 2012). All of these developments show promise for improving the clinical and/ or cost-effectiveness of an aspect or all of an asymptomatic chlamydia screening pathway. There is an opportunity for learning across these developments to further enhance the delivery of care, however there is a risk that development of these technologies in isolation will lead to fragmented solutions to individual aspects of the pathway. Both awareness of these developments and/ or collaboration could contribute to the development of more effective products.

Further research is also required to understand how these areas of development may impact on preferences for the use of new technologies for the management of STIs other than chlamydia. In particular, given the distinctions drawn out by young people in the focus groups between thinking about differences in the consequences of disease, for example, HIV and chlamydia, it is likely that their preferences for attributes in respect of self-testing and eHealth clinics may vary based on whether the disease is curable. However, recognising that chlamydia testing and treatment is offered currently as a standalone pathway for young people, the DCE draws out a number of ways in which current pathways could be enhanced by the adoption of either OCCP and/ or self-testing.

Since the approach adopted for the early economic evaluation presented in this thesis was based on the NICE MTEP (NICE, 2011) methods, the costs incurred to the NHS were included and patient costs were excluded. Recognising the intrinsic link between uptake of eHealth interventions and their cost-effectiveness (McNamee et al., 2016) future research into the patient-borne costs (e.g. travel, internet access) associated with current screening pathways, the OCCP and a fully remote online pathway for the testing and treatment of chlamydia would be beneficial. Another feature of the NICE MTEP approach is the determining point at which a technology is recommended for use within the NHS, i.e. outcomes equivalent to existing practice. Whilst the data from the OCCP does not currently demonstrate this, further modelling to test whether there is a point at which a sub-optimal technology (e.g. less sensitive test) could offer benefits. This has not been explored in the economic modelling undertaken in this thesis because it is not currently recognised as acceptable within the framework for considering new technologies for adoption by the NHS.

In progressing the economic evaluation beyond the initial exploratory study of the costs and consequences of the OCCP, alternative health economic methods might be more appropriate, particularly for a full scale RCT (Sculpher et al., 1997). McNamee and colleagues note that whilst there are a range of guidelines for health economic evaluations, little consideration has been given to their applicability to digital health interventions (McNamee et al., 2016). Consideration would also need to be given to the acknowledged issues associated with estimating QALYs in economic evaluations of chlamydia interventions (ECDC, 2014) when selecting the method.

One of the key issues is the pace of digital health technology development and therefore consideration should be given as to whether the existing methods used in HTA are appropriate to digital health interventions. Baker and colleagues have highlighted that it can take seven years from the submission of a grant proposal to the publication of the research (Baker et al., 2014). During the last seven years (2010-2016), daily internet access has increased from approximately 60% to 82% (all adults) (Office for National Statistics, 2016b), the functionality of smartphones, and smartphone consumables have increased significantly to include a range of devices capable of monitoring health data linked to the smartphone, and the availability of apps and their functionality has also extended over time. Further work is required to establish appropriate rapid methods for the evaluation of pathways which involve eHealth technologies.

9.5 Implications for Healthcare Policy & Delivery

Since the commencement of this research in 2013 there have been significant changes both in terms of the commissioning and delivery of sexual health services in England, and the advancement of digital technology which have the potential to produce a material impact on service configuration and delivery within mainstream sexual health services. Chapter 2 of this thesis set out the 'best intentions' of government in respect of technology adoption within healthcare more generally and sexual health services specifically. These included using online/ remote consultation (Department of Health, 2012), and expanding internet testing services for STIs (Department of Health, 2013). Despite the advancement of digital health technologies, the pace of their adoption within mainstream sexual health services has not materially changed during the course of this research.

The use of such technologies is still confined to isolated examples within the NHS, reflecting the pattern of adoption noted by the WHO in their international study of eHealth and mHealth adoption (WHO, 2011a). Attempts to increase the pace and spread of digital technologies through approaches such as the NHS apps library have been hampered by information security and governance concerns (Huckvale et al., 2015).

The research undertaken by Gibbs and colleagues in developing the OCCP has highlighted the stark disconnect between the national policy vision for digital health and the reality of designing an online treatment eHealth intervention concluding that "much of the infrastructure and legislation/ regulation and best practice guidance required to support such a shift in the provision of care has been designed for traditional, non-eHealth, service provision and is not fit for purpose for innovative eHealth interventions." (Gibbs, 2015:310). The most significant example of this within the OCCP development is the national electronic prescribing system (EPS) being designed for the transmission of electronic prescriptions from GP practice to community pharmacy rather than any other healthcare provider to pharmacy. A secondary issue is that it is currently not possible to use the EPS without an NHS number, which is not used by sexual health services to preserve patient anonymity. This is a significant limitation for the implementation of digital health technologies in sexual health services which involve the prescribing of drugs for treatment which will need to be addressed in future EPS upgrades. There are examples of accreditation processes for telehealth initiatives such as the European Code of Practice for Telehealth Services (TeleSCoPE, 2014) however this falls short of the requirements of digital health interventions delivering diagnosis and treatment as it does not incorporate any assessment of the clinical safety of the intervention.

In parallel to this, the commissioning of sexual health services in England has been fragmented, with responsibility split between local authorities, CCGs and NHSE. Whilst conclusive links on the impact of this split have not yet been drawn, concern has been expressed by both the House of Commons Health Select Committee and professional bodies including BASHH, and the Royal College of Physicians regarding the split between HIV treatment and care and other sexual health services (BASHH, 2013, House of Commons. Select Committee on Health, 2011). Examples of such splits are now starting to emerge including the example of sexual health services in Cheshire West where HIV and sexual health services are now delivered by two different providers and therefore the HIV service can no longer treat other STIs (BMA, 2015). This has led to a call from BASHH for "a strong national steer for co-commissioning of HIV, sexual health and reproductive health services" (Clarke and Carlin, 2014).

Although the 2015 budget announced £8 billion more for the NHS by 2020 (Hazell, 2015), an in-year budget cut of £200 million was made to local authority public health budgets for 2015-16 (Williams, 2015) and estimates of a reduction of £3.3 billion in central government funding for local services were forecast by the Local Government Association (Local Government Association, 2015) for 2016-17 (the first year without ring fencing of the public health budget). The cost of testing and treatment for STIs is borne by the LA, however the benefits gained through the avoidance of long term complications such as PID or infertility accrue to NHS commissioning organisations, primarily CCGs. Emerging tensions in STI commissioning responsibilities have recently been demonstrated in the courts with a legal challenge brought against NHS England in respect of who has the power to commission pre-exposure prophylaxis drugs for HIV with NHS England arguing that the legal power is with LAs and the National AIDS Trust arguing that it is with NHS England (BBC, 2016).

Whilst local authorities generally adopt a similar approach to NHS organisations in appraising developments it is unclear whether they will consider the implications for other commissioning organisations in their decision making. It is possible that a broader range of outcomes might be considered, drawing out links to potential savings on other local authority controlled budgets and impacts on other areas of service delivery within local authority control. Although this approach has been incorporated into public health guideline development (NICE, 2014), it is not an approach usually taken in DAP/ MTEP evaluations. This area warrants further research to understand how economic evaluations can incorporate a range of intermediate and final outcome measures and the weight that should be placed on the impact on NHS versus local authority opportunity costs.

There has been a plethora of guidance on effective commissioning following the move to LA commissioning in April 2013 including model contracts and service specifications issued by the Department of Health (Department of Health, 2013a, Department of Health, 2013d), guidance from Public Health England on whole system commissioning (Public Health England, 2014b) and from the NCSP on the effective commissioning of chlamydia testing, treatment and partner notification (NCSP, 2012a). However, despite this, and a number of sexual health services being reviewed and re-procured, achievement of the PHOF indicator for chlamydia diagnoses has declined year on year since 2013 (Public Health England, 2014d, Public Health England, 2015, Public Health England, 2016b).

No evaluation of the impact of the revised commissioning arrangements on the implementation of the 2013 sexual health strategy has been formally undertaken however the fragmentation of services and reduction in chlamydia diagnoses suggest that the aims of the strategy to prioritise prevention and ensure young people can access appropriate services are increasingly not being met.

Considering both the general (Department of Health, 2012) and sexual health (Department of Health, 2013) policy imperative for the adoption of innovative technology into mainstream health services, the operational climate for the commissioning and implementation of new remote online pathways into sexual health services is positive. However, whilst reductions in LA commissioning budgets are a key driver for seeking out alternative delivery models which reduce costs without affecting outcomes, the relative infancy of the new commissioning arrangements are not conducive to this.

9.6 Concluding Remarks

This thesis has added new knowledge to the evidence base in respect of the factors important to young people when choosing to test and access treatment for chlamydia, and the relative strength of preference for those factors. This information should help inform both technology developers and commissioners, in shaping digital pathways for the delivery of these services. The economic modelling has also contributed new knowledge by providing an insight into the likely costs and benefits of implementing a fully remote online pathway or an OCCP into mainstream sexual health services. It has highlighted specific areas where further development of these pathways is required to maximise the likelihood that the technology will be cost-effective. It has also demonstrated that both the OCCP and a fully remote online pathway are likely to be used by young people for the testing and treatment of chlamydia, that the pathways are likely to be cost saving compared with current practice, although, further development is required to improve partner treatment uptake. The fully remote online pathway has the potential to be a viable replacement for the NCSP internet testing pathway. Although face-to-face services will still be required for the management of symptomatic patients and patients unsuitable for online management these services could be rationalised leading to further cost savings. The challenge now is whether the OCCP and fully remote online pathway can be progressed to a point where they are clinically safe and cost-effective before the rapid evolution of digital technology renders them obsolete.

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Appendix 1 – Background to the eSTI^2 Research Programme

Formed from a collaboration of academic, NHS and commercial partners the Electronic Self-Testing for Sexually Transmitted Infections (eSTI^2) consortium brings together point of care (POC) and self-testing diagnostic technologies for STIs with mobile technology to deliver rapid access to diagnosis and treatment. The stated aim of the eSTI^2 programme research is to "reduce the high impact of STIs, a national priority for UK health, by building translational capacity to develop, improve, evaluate and implement simple to use, rapid, accurate, polymicrobial and affordable POC and non-POC micro-diagnostics that can be mobile-phone networked." (eSTI^2 Consortium 2010:1). The consortium supports a number of PhD fellowships focusing on different aspects of the programme.

This doctoral research is focused on exploring the costs and benefits of introducing novel diagnostic and communication technologies for STI control into mainstream NHS practice and sits within work stream 4 of the eSTI^2 research programme. The eSTI^2 research programme to date is focused on the testing and treatment of chlamydia. A breakdown of the work streams is provided in the table below.

Work Stream	Work Stream Remit
Work Stream 1 (WS1) - Micro-engineering	Development of prototype STI testing platforms which will ultimately interface with mobile phones.
Work Stream 2 (WS2) - Microbiology	Research supporting the development of biosensor and sample processing devices for multiple STI and antibiotic resistance testing
Work Stream 3 (WS3) - Diagnostic evaluation	Working with industry partners on prospective clinical evaluation of novel STI diagnostic tests to enable the rapid assessment of technology.
Work Stream 4 (WS4) - Public health	Developing clinical care pathways and investigating the barriers to adoption of POC and self-tests for STIs from a regulatory, ethical and economic perspective.

WS4 has piloted a clinical care pathway using a non-native app (accessible via PC and mobile phone) for the treatment of chlamydia and partner notification (July 2014 – March 2015), and WS1, WS2 and WS3 are aiming to deliver a remote POCT by late 2016. In addition to the eSTI^2 WS1 and WS2 research on in house test development, there is potential for tests to be developed by one of the commercial collaborators working with WS3 of the project.

The range of pathogens which could fall within the scope of the eSTI^2 pathway are identified in the original eSTI^2 research proposal as: Neisseria Gonorrhoeae, Chlamydia trachomatis, Ureaplasma parvum, Mycoplasma genitalium, Trichomonas vaginalis, Candida albicans, Bacterial vaginosis associated organisms, Herpes simplex 1&2 and Treponema pallidum (eSTI^2 Consortium, 2010). At the current time it is anticipated that the first test to be piloted will be for chlamydia, followed by gonorrhoea.

The proposed approach to infectious disease diagnosis, treatment and surveillance, which will ultimately combine self-testing and mHealth, is revolutionary. At the time of piloting, the clinical care pathway (OCCP) for the treatment of chlamydia will be the first pathway to prescribe a prescription only medicine for treatment without direct contact with a clinician.

Appendix 2 – BSREC Approval Letter – DCE Focus Groups & Pilot

24th June 2014

Warwick Medical School

PRIVATE
Sue Eaton
C/O Stavros Petrou
Health Sciences
Warwick Medical School
Gibbet Hill Road
Coventry
CV4 7AL

Dear Sue

Study Title and BSREC Reference: *Patient preferences for Sexually Transmitted Infection Testing and Access to Treatment* **REGO-2014-694**

Thank you for submitting your revisions to the above-named project to the University of Warwick's Biomedical and Scientific Research Ethics Sub-Committee for approval.

I am pleased to confirm that approval is granted and your study may commence.

Please keep a copy of the signed version of this letter with your study documentation.

Yours sincerely

pp

David Davies
Chair
Biomedical and Scientific
Research Ethics Sub-Committee

Biomedical and Scientific Research Ethics Sub-Committee
A010 Medical School Building
Warwick Medical School,
Coventry, CV4 7AL.
Tel: 02476-151875
Email: BSREC@Warwick.ac.uk

Medical School Building
The University of Warwick
Coventry CV4 7AL United Kingdom
Tel: +44 (0)24 7657 4880
Fax: +44 (0)24 7652 8376

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Appendix 3 – BSREC Approval Letter – DCE Full Study

WARWICK
MEDICAL SCHOOL

PRIVATE
Mrs Sue Eaton
PhD Student
Health Sciences
WMS
University of Warwick
Coventry
CV4 7AL

22nd October 2015

Dear Mrs Eaton,

Study Title and BSREC Reference: *What attributes influence young people's preferences for Chlamydia testing and treatment?* REGO-2015-1647

Thank you for submitting your revisions to the above-named study to the University of Warwick's Biomedical and Scientific Research Ethics Sub-Committee for approval.

I am pleased to confirm that approval is granted and that your study may commence.

In undertaking your study, you are required to comply with the University of Warwick's *Research Data Management Policy*, details of which may be found on the Research and Impact Services' webpages, under "Codes of Practice & Policies" » "Research Code of Practice" » "Data & Records" » "Research Data Management Policy", at:
http://www2.warwick.ac.uk/services/ris/research_integrity/code_of_practice_and_policies/research_code_of_practice/datacollection_retention/research_data_mgt_policy

You are also required to comply with the University of Warwick's *Information Classification and Handling Procedure*, details of which may be found on the University's Governance webpages, under "Governance" » "Information Security" » "Information Classification and Handling Procedure", at:
http://www2.warwick.ac.uk/services/gov/informationsecurity/handling.
Investigators should familiarise themselves with the classifications of information defined therein, and the requirements for the storage and transportation of information within the different classifications:

Information Classifications:
http://www2.warwick.ac.uk/services/gov/informationsecurity/handling/classifications
Handling Electronic Information:
http://www2.warwick.ac.uk/services/gov/informationsecurity/handling/electronic/
Handling Paper or other media
http://www2.warwick.ac.uk/services/gov/informationsecurity/handling/paper/.

www.warwick.ac.uk

Please also be aware that BSREC grants **ethical approval** for studies. **The seeking and obtaining of *all* other necessary approvals is the responsibility of the investigator.**

These other approvals may include, but are not limited to:

1. Any necessary agreements, approvals, or permissions required in order to comply with the University of Warwick's Financial Regulations and Procedures.
2. Any necessary approval or permission required in order to comply with the University of Warwick's Quality Management System and Standard Operating Procedures for the governance, acquisition, storage, use, and disposal of human samples for research.
3. All relevant University, Faculty, and Divisional/Departmental approvals, if an employee or student of the University of Warwick.
4. Approval from the applicant's academic supervisor and course/module leader (as appropriate), if a student of the University of Warwick.
5. NHS Trust R&D Management Approval, for research studies undertaken in NHS Trusts.
6. NHS Trust Clinical Audit Approval, for clinical audit studies undertaken in NHS Trusts.
7. Approval from Departmental or Divisional Heads, as required under local procedures, within Health and Social Care organisations hosting the study.
8. Local ethical approval for studies undertaken overseas, or in other HE institutions in the UK.
9. Approval from Heads (or delegates thereof) of UK Medical Schools, for studies involving medical students as participants.
10. Permission from Warwick Medical School to access medical students or medical student data for research or evaluation purposes.
11. NHS Trust Caldicott Guardian Approval, for studies where identifiable data is being transferred outside of the direct clinical care team. Individual NHS Trust procedures vary in their implementation of Caldicott guidance, and local guidance must be sought.
12. Any other approval required by the institution hosting the study, or by the applicant's employer.

There is no requirement to supply documentary evidence of any of the above to BSREC, but applicants should hold such evidence in their Study Master File for University of Warwick auditing and monitoring purposes. You may be required to supply evidence of any necessary approvals to other University functions, e.g. The Finance Office, Research & Impact Services (RIS), or your Department/School.

May I take this opportunity to wish you success with your study, and to remind you that any Substantial Amendments to your study require approval from BSREC before they may be implemented.

Yours sincerely

P.P. Graham Hewitt

Professor Scott Weich
Chair
Biomedical and Scientific
Research Ethics Sub-Committee

Biomedical and Scientific Research Ethics Sub-Committee
A010 Medical School Building
Warwick Medical School,
Coventry, CV4 7AL.
T: 02476-528207
E: BSREC@Warwick.ac.uk

http://www2.warwick.ac.uk/services/ris/research_integrity/researchethicscommittees/biomed

Appendix 4 – BSREC Approval Letter – Costing Study

19th May 2015

Warwick Medical School

PRIVATE
Mrs Sue Eaton
Health Sciences
WMS
University of Warwick
Coventry
CV4 7AL

Dear Mrs Eaton,

Study Title and BSREC Reference: *Identification of pathways, costs and performance monitoring data for Chlamydia testing and treatment* REGO-2015-1497

Thank you for submitting the above-named project to the University of Warwick Biomedical and Scientific Research Ethics Committee for research ethical review.

I am pleased to advise that research ethical approval is granted.

May I take this opportunity to wish you success with the study, and to remind you that any substantial amendments require approval from BSREC before they can be implemented. Please keep a copy of the original signed version of this letter with your study documentation.

Yours sincerely

P.P. Graham Hewitt

Professor Scott Weich
Chair
Biomedical and Scientific
Research Ethics Sub-Committee

Biomedical and Scientific Research Ethics Sub-Committee
A010 Medical School Building
Warwick Medical School,
Coventry, CV4 7AL.
Tel: 02476-528207
Email: BSREC@Warwick.ac.uk

Medical School Building
The University of Warwick
Coventry CV4 7AL United Kingdom
Tel: +44 (0)24 7657 4880
Fax: +44 (0)24 7652 8375

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Appendix 5 – OECD List of High Income Countries

OECD High Income Countries as at 25th July 2014:

1. Australia
2. Austria
3. Belgium
4. Canada
5. Chile
6. Czech Republic
7. Denmark
8. Estonia
9. Finland
10. France
11. Germany
12. Greece
13. Iceland
14. Ireland
15. Israel
16. Italy
17. Japan
18. Korea
19. Luxembourg
20. Netherlands
21. New Zealand
22. Norway
23. Poland
24. Portugal
25. Slovak Republic
26. Slovenia
27. Spain
28. Sweden
29. Switzerland
30. United Kingdom
31. United States

Source: OECD, 2014

Appendix 6 – Example Medline Search Strategy

Database(s): **Ovid MEDLINE(R)** 1946 to April Week 3 2014
Search Strategy:

#	Searches	Results
1	exp Sexually Transmitted Diseases/ or sexually transmitted.mp.	282485
2	(STI or STD).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	12391
3	sexual health.mp. or exp Reproductive Health/	4915
4	1 or 2 or 3	288603
5	exp Patient Preference/ or exp Choice Behavior/ or stated preference.mp.	41766
6	stated choice.mp.	29
7	discrete choice.mp.	570
8	DCE.mp.	2421
9	conjoint analysis.mp.	336
10	contingent valuation.mp.	390
11	willingness to pay.mp.	2068
12	WTP.mp.	773
13	willingness to accept.mp.	358
14	WTA.mp.	171
15	visual analogue scale.mp.	11436
16	VAS.mp.	25873
17	rating scale.mp.	28065
18	magnitude estimation.mp.	697
19	standard gamble.mp.	635
20	SG.mp.	5193
21	time trade off.mp.	706
22	TTO.mp.	558
23	person trade off.mp.	43
24	PTO.mp.	497
25	functional measurement.mp.	125
26	paired comparison*.mp.	1628
27	pairwise choice*.mp.	16
28	conjoint measurement.mp.	43
29	part worth util*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	7
30	conjoint stud*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease	14

	supplementary concept word, unique identifier]	
31	conjoint choice.mp.	7
32	choice exercise*.mp.	11
33	random paired scenario*.mp.	2
34	payment card.mp.	29
35	allocation of point*.mp.	6
36	analytic hierarchy process.mp.	228
37	measure of value.mp.	23
38	5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37	115063
39	4 and 38	908
40	limit 39 to (english language and humans and yr="2000 - 2013")	625

Appendix 7 – Data Extraction Form

Data Extraction Form – Review of Stated Preference Studies – DCE or Conjoint Analysis

Study Title:	
Full Publication Reference:	
Linked Publications:	
Date form Completed:	
Name of Person Extracting Data:	
Notes:	

1. Summary Study Characteristics:

Study Characteristics	
Study Objective:	
Focus of Study e.g. product, service:	
Type of Stated Preference Study:	
Application:	
Year of Study:	
Sample Population:	
Sample Size:	
Attributes Included:	
Demographics Included:	
Number of Attributes:	
Range in Number of Levels per Attribute:	
Full or Partial Profile:	
Number of Profiles in Each Questionnaire:	
Opt out/ Status quo option included:	
Form used – generic or alternative specific:	
Type of experimental design used:	
Efficiency Score:	
Model Used:	
Software used for analysis:	

2. Reporting Quality:

Reporting Quality	
1.1 Were a well-defined research question and a testable hypothesis articulated?	

1.2 Was the study perspective described, and was the study placed in a particular decision-making or policy context?	
1.3 What is the rationale for using conjoint analysis to answer the research question?	
2.1 Was attribute identification supported by evidence (lit reviews, focus groups or other scientific methods)?	
2.2 Was attribute selection justified and consistent with theory?	
2.3 Was level selection for each attributed justified by the evidence and consistent with the study perspective and hypothesis?	
3.1 Was the number of attributes in each conjoint task justified (that is full or partial profile)?	
3.2 Was the number of profiles in each conjoint task justified?	
3.3 Was (should) an opt out or status quo alternative be included?	
4.1 Was the choice of experimental design justified? Were alternative experimental designs considered?	
4.2 Were the properties of the experimental design evaluated?	
4.2a Efficiency Score:	
4.2b Correlations among attribute levels:	
4.2c Correlations among attribute level differences:	
4.2d Level balance:	
4.2e Number of overlapping attributes:	
4.2f Restrictions on implausible combinations:	
4.2g Cognitive difficulty:	
4.3 Was the number of conjoint tasks included in the data collection instrument appropriate?	
5.1 Was there sufficient motivation and explanation of conjoint tasks?	
5.2 Was an appropriate elicitation format used? Did (should) the elicitation format allow for indifference?	
5.3 In addition to preference elicitation, did the conjoint tasks include other qualifying questions	

(e.g. strength of preference)?	
6.1 Was appropriate respondent information collected?	
6.2 Were the attributes and levels defined, and was contextual information provided?	
6.3 Was the level of burden of the data collection instrument appropriate? Were respondents encouraged and motivated?	
7.1 Was the sampling strategy justified?	
7.2 Was the mode of administration justified and appropriate?	
7.3 Were ethical considerations addressed?	
8.1 Were respondent characteristics examined and tested?	
8.2 Was the quality of the responses examined (rationality, validity, reliability)?	
8.3 Was model estimation conducted appropriately? Were issues of clustering and sub-groups handled appropriately?	
9.1 Did study results reflect testable hypotheses and account for statistical uncertainty?	
9.2 Were study conclusions supported by the evidence and compared with existing findings in literature?	
9.3 Were study limitations and generalizability adequately discussed?	
10.1 Was study importance and research context adequately motivated?	
10.2 Were the study data collection instrument and methods described?	
10.3 Were the study implications clearly stated and understandable to a wide audience?	

Appendix 8 – Summary of Assessment Against the ISPOR Good Practice Checklist

Checklist for conjoint analysis in health care	Albus et al., (2005)	Beusterien et al., (2005)	Hauber et al., (2009)	Hsieh et al., (2011)	Llewellyn et al., (2013)	Miners et al., (2012)	Phillips et al., (2002)	Ryan and Watson (2009)	Scalone et al., (2011)	Tanner et al., (2008)	Watson et al., (2009)	Young Holt et al., (2006)
1.1 – Were a well-defined research question and testable hypothesis articulated?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.2 – Was the study perspective described, and was the study placed in a particular decision-making or policy context?	✓	✓	*p*	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.3 – What is the rationale for using conjoint analysis to answer the research question?	*p*	✓	✓	✓	✓	*p*	✓	✓	*p*	✓	✓	✓
2.1 – Was attribute identification supported by evidence (literature reviews, focus groups or other scientific methods)?	✓	✓	×	✓	*p*	✓	✓	×	×	✓	*p*	✓
2.2 – Was attribute selection justified and consistent with theory?	✓	×	×	✓	×	✓	✓	×	×	*p*	*p*	✓
2.3 – Was level selection for each attribute justified by the evidence and consistent with the study perspective and hypothesis?	✓	*p*	*p*	✓	×	*p*	✓	×	×	*p*	*p*	✓

Checklist for conjoint analysis in health care	Albus et al., (2005)	Beusterien et al., (2005)	Hauber et al., (2009)	Hsieh et al., (2011)	Llewellyn et al., (2013)	Miners et al., (2012)	Phillips et al., (2002)	Ryan and Watson (2009)	Scalone et al., (2011)	Tanner et al., (2008)	Watson et al., (2009)	Young Holt et al., (2006)
3.1 – Was the number of attributes in each conjoint task justified (that is, full or partial profile)?	✓	✗	✗	✗	✗	*p*	✓	✗	✗	*p*	*p*	✓
3.2 – Was the number of profiles in each conjoint task justified?	*p*	✗	✗	✗	✗	*p*	✓	✗	✗	*p*	✗	✓
3.3 – Was (should) an opt-out or status-quo alternative (be) included?	✗	✗	✗	✗	*p*	✗	✗	*p*	✓	✗	✗	✗
4.1 – Was the choice of experiment design justified? Were alternative experimental designs considered?	✗	✗	✗	✗	✗	✓	*p*	✓	✗	✗	*p*	*p*
4.2 – Were the properties of the experimental design evaluated?	✗	✗	✗	✗	*p*	*p*	✓	*p*	✗	✗	*p*	*p*
4.3 – Was the number of conjoint tasks included in the data collection instrument appropriate?	✗	✗	✗	✓	*p*	✓	✓	✓	✗	✗	✗	✓
5.1 – Was there sufficient motivation and explanation of conjoint tasks?	✗	✗	✓	*p*	*p*	✗	*p*	✗	✗	✓	*p*	✓
5.2 – Was an appropriate elicitation format (rating, ranking or choice) used? Did (should) the elicitation format allow for indifference?	✗	✗	✓	✗	✗	*p*	*p*	✗	✗	✗	✓	*p*

Checklist for conjoint analysis in health care	Albus et al., (2005)	Beusterien et al., (2005)	Hauber et al., (2009)	Hsieh et al., (2011)	Llewellyn et al., (2013)	Miners et al., (2012)	Phillips et al., (2002)	Ryan and Watson (2009)	Scalone et al., (2011)	Tanner et al., (2008)	Watson et al., (2009)	Young Holt et al., (2006)
5.3 – In addition to preference elicitation, did the conjoint tasks include other qualifying questions (for example strength of preference, confidence in response, and other methods)?	✗	✓	✗	✗	*p*	✗	*p*	*p*	*p*	✗	✗	*p*
6.1 – Was appropriate respondent information collected (e.g. socio-demographic, health history etc)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6.2 – Were attributes and levels defined, and was any contextual information provided?	✗	✗	*p*	✗	*p*	✗	✗	✗	✗	*p*	*p*	✓
6.3 – Was the level of burden of the data collection instrument appropriate? Were respondents encouraged and motivated?	✗	*p*	*p*	✗	*p*	✗	✗	✗	✗	✗	✗	*p*
7.1 – Was the sample strategy justified (e.g. sample size, stratification and recruitment)?	✗	*p*	✗	✗	*p*	*p*	*p*	✗	*p*	✗	✗	✗
7.2 – Was the mode of administration justified and appropriate (e.g. face to face, pen and paper, web-based)?	✗	✗	✗	✗	✗	✗	✗	✗	✗	*p*	✗	*p*

Checklist for conjoint analysis in health care	Albus et al., (2005)	Beusterien et al., (2005)	Hauber et al., (2009)	Hsieh et al., (2011)	Llewellyn et al., (2013)	Miners et al., (2012)	Phillips et al., (2002)	Ryan and Watson (2009)	Scalone et al., (2011)	Tanner et al., (2008)	Watson et al., (2009)	Young Holt et al., (2006)
7.3 – Were ethical considerations addressed (e.g. recruitment, information and/or consent, compensation)?	✗	p	p	p	p	p	p	p	✗	p	p	p
8.1 – Were respondent characteristics examined and tested?	✓	p	p	p	✓	✓	✓	✓	✓	p	✓	✓
8.2 – Was the quality of the responses examined (e.g. rationality, validity, reliability)?	p	✓	✓	✗	✓	✓	✓	✓	p	p	✗	✓
8.3 – Was model estimation conducted appropriately? Were issues of clustering and sub-groups handled appropriately?	✗	✗	✗	p	p	✓	✓	p	p	p	p	✓
9.1 – Did study results reflect testable hypotheses and account for statistical uncertainty?	✗	✗	✗	✗	✓	✓	p	✓	p	p	p	p
9.2 – Were study conclusions supported by the evidence and compared with existing findings in the literature?	p	✓	p	p	✓	✓	p	✓	p	✓	✓	p
9.3 – Were study limitations and generalizability adequately discussed?	p	✓	✓	✓	✓	✓	p	✓	p	p	✓	✗

Checklist for conjoint analysis in health care	Albus et al., (2005)	Beusterien et al., (2005)	Hauber et al., (2009)	Hsieh et al., (2011)	Llewellyn et al., (2013)	Miners et al., (2012)	Phillips et al., (2002)	Ryan and Watson (2009)	Scalone et al., (2011)	Tanner et al., (2008)	Watson et al., (2009)	Young Holt et al., (2006)
10.1 –Was study important and research context adequately motivated?	✓	*p*	*p*	✓	✓	✓	✓	✓	✓	✓	✓	✓
10.2 – Were the study data-collection instrument and methods described?	*p*	*p*	*p*	✓	*p*	*p*	*p*	*p*	✓	*p*	*p*	✗
10.3 – Were the study implications clearly stated and understandable to a wide audience?	*p*	*p*	*p*	✓	✓	✓	*p*	✓	*p*	✓	✓	✓

Appendix 9 – Preferences & Acceptability of Mainstream Sexual Health Services Search Strategy

Medline

#	Searches	Results
1	exp Reproductive Health/	1255
2	exp Sexually Transmitted Diseases/ or sexually transmitted*.mp.	300983
3	(STI or STD).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	13506
4	1 or 2 or 3	305647
5	test*.mp.	2882446
6	treatment.mp.	3327476
7	service.mp.	248426
8	Patient Preference/	3912
9	acceptab*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	108974
10	exp Choice Behavior/ or choice.mp.	224059
11	uptake.mp.	278539
12	access*.mp.	330379
13	5 or 6 or 7	5886436
14	8 or 9 or 10 or 11 or 12	918715
15	4 and 13 and 14	11413
16	limit 15 to (english language and humans)	10491
17	limit 16 to yr="2004 - 2014"	7375

Appendix 10 – Preference & Acceptability of Mainstream Sexual Health Services – Summary of Included Papers

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
1.	Alvarez-del Arco, D et al (2013)	HIV testing and counselling for migrant populations living in high-income countries: a systematic review	Migrants have specific legal and administrative impediments to accessing HIV testing-in some countries, undocumented migrants are not entitled to health care-as well as cultural and linguistic barriers, racism and xenophobia. Migrants and ethnic minorities fear stigma from their communities, yet community acceptance is key for well-being.		Stigma Community Acceptance
2.	Anhang, R., et al. (2005)	Acceptability of self-collection of specimens for HPV DNA testing in an urban population compared with clinician collected	ease of use, less painful procedure, could do it myself, privacy were desirable characteristics of self-sampling, but overall majority (68%) preferred clinician collected test	Sample Collection Method (Self-Sample, Clinician Collected Sample)	Privacy
3.	Apoola, A., et al. (2007)	Preferences for partner notification method: variation in responses between respondents as index patients and contacts	there are variations in the preferences of respondents for PN method which depend on whether respondents see themselves as index patients or contacts	Partner Notification Method	

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4.	Ashby, J., et al. (2012)	HIV POC testing uptake and acceptability in an inner city polyclinic	90% found service helpful and useful, 86% found the service to be convenient and helpful	Type of Test	Convenience
5.	Baker, J. R., et al. (2013)	Barriers to discussing and testing for STIs in GP practices	Patients comfortable discussing and testing for STIs with GPs, this is enhanced if GPs have specialist qualification and reduced if they know the GP socially	Type of Healthcare Professional Knowledge of Healthcare Professional	Knowledge of healthcare professional socially
6.	Balfe, M. and R. Brugha (2009)	Why do young adults attend STI testing services	4 reasons for testing: - transitional moment in their lives - they had had unprotected sex - had symptoms of STI - required to do so by employer Barriers included concerns about stigma, being judged and invulnerability		4 reasons for testing: - transitional moment in their lives - they had had unprotected sex - had symptoms of STI - required to do so by employer Stigma Being judged invulnerability

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7.	Balfe, M. and R. Brugha (2011)	Young adults concerns about attending for STI testing	Concerns include: - Stigma - asking health professionals for advice - sourcing information on services - attending specific STI clinics - being recognised	Location of test Access to Healthcare Professional	- Stigma - asking health professionals for advice - sourcing information on services - attending specific STI clinics - being recognised
8.	Balfe, M., et al. (2010)	Location of chlamydia screening services	Screening available in locations where they would not be witnessed asking for or being asked to take a test	Location of testing	
9.	Baraitser, P., et al. (2011)	Client experience of self-management within a sexual health clinic	Self-management in clinic an acceptable option if informal support is available, valued reduced waiting time, autonomy and privacy	Access to Healthcare Professional How you test	Privacy

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10.	Basta, M. S. T., et al. (2009)	Clinician examination of asymptomatic GUM attendees	98% of women and 91% of men prefer to be examined when attending clinic	Sample collection method	
11.	Bilardi, J. E., et al. (2013)	Views on rapid self-testing for HIV	Would be useful as an additional rather than replacement tool due to test being for single STI and lack of professional expertise and support	Type of Test Access to Healthcare Professional	
12.	Booth, A. R., et al. (2013)	Beliefs about chlamydia testing	Need to reduce the negative social implications of testing and treatment, highlight positive value of reassurance. In particular the feeling of embarrassment associated with testing		Embarrassment Positive value of reassurance
13.	Brown, L., et al. (2008)	Preferred options for receiving test results	Preference to receive test results even if they're negative, majority prefer coded results slip	Results Notification	
14.	Brown, L., et al. (2010)	Acceptability of non-invasive testing	Non-invasive tests acceptable alternative to physician administered tests in asymptomatic patients	Sample collection method	

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15.	Brugha, R., et al. (2011)	Preferred options for receiving chlamydia screening test results	Call to mobile phone preferred way of receiving results followed by email. Text messages and calls to landlines were most unpopular options	Results Notification	
16.	Challenor, R. and Z. Warwick (2010)	Saturday services - patients views	Services on Saturdays more popular than Sundays	Service Access Times	
17.	Chaudhary, R., et al. (2008)	Male perspectives on provision of chlamydia screening	Attitudes affected by lack of knowledge, perception it's a women's disease, social embarrassment, reluctance to seek help, indifference to health promotion campaigns		Lack of knowledge Social embarrassment Reluctance to seek help
18.	Cohall, A., et al. (2010)	Men's views of rapid HIV testing	Population generally aware of rapid testing but need greater focus on psychosocial needs - need time to prepare for potentially life changing diagnosis	Access to healthcare professional Type of test	
19.	de Wit, J. B. F. and P. C. G. Adam (2008)	Psychosocial barriers to HIV testing	Discrimination and rejection most common reasons for not testing		Discrimination Rejection

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20.	Deblonde, J., et al. (2010)	Barriers to HIV testing in Europe	The barriers described are centralized around low-risk perception; fear and worries; accessibility of health services, reluctance to address HIV and to offer the tests; and scarcity of financial and well trained human resources	Accessibility of services Access to healthcare professional	Low risk perception
21.	Doshi, J. S., et al. (2008)	Acceptability of self taken vaginal swabs within chlamydia screening programme	90.4% chose to provide a self taken vaginal swab and 5.8% chose to provide a urine sample as an alternative	Sample collection method	
22.	Fakoya, I., et al. (2008)	Barriers to HIV testing	Barriers identified include access to testing, fear of disease/ diagnosis, fear of stigma and discrimination	Access to Testing	Fear of disease/diagnosis Stigma Discrimination
23.	Fernando, I. and D. Clutterbuck (2008)	Patient views on information sharing between GUM and GPs	Mode of referral and concerns about implications of HIV testing affect patient preferences on information sharing. Significant proportion of patients want visits to remain anonymous		Anonymity

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24.	Fernando, I. and C. Thompson (2013)	Acceptability of implementation of no talk testing clinic in GUM for asymptomatic patients	Results indicated it was acceptable - speed, efficiency, capacity and reduced waiting times were identified as important	Sample Collection Method Waiting times	
25.	Fielder, R. L., et al. (2013)	Acceptability of self taken vaginal swabs	High participation rate, low rate of discomfort with testing method, high willingness to retest using self-taken vaginal swabs in the future.	Sample Collection Method	
26.	Frasca, T., et al. (2014)	Attitude and behaviour changes in light of rapid HIV testing amongst gay and bisexual men	Approximately 50% of participants reported changes in attitudes leading to risk reduction linked to self-testing	Testing Method	
27.	Friedman, A. L. and B. Bloodgood (2013)	Alternative testing venues for chlamydia screening programme	Alternative testing venues are valued for their convenience and accessibility however must also offer emotional/ informational support, privacy and confidentiality	Location of Test	Privacy Confidentiality Emotional/ informational support Convenience

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28.	Garrett, C. C., et al. (2011)	Young people's views on telemedicine consultations for sexual health	29% of respondents indicated that they'd use webcam consultation compared with 63% for telephone and 85% for in person	Access to healthcare professional	
29.	Garrett, C. C., et al. (2012)	Telemedicine for young people in rural locations	Telephone consultation was preferable to consulting a doctor in person	Access to healthcare professional	
30.	Gaydos, C. A., et al. (2006)	Focus groups to design internet based intervention for self-sampling for chlamydia	self-sampling and internet intervention viewed positively	Sample Collection Method Location of Test	
31.	Gilbert, M., et al. (2013)	Intentions to use internet based testing for STIs for MSM	Internet based testing has the potential to reach all MSM sub-groups and may be of particular benefit to those who currently face barriers to accessing testing	Location of Test	
32.	Glasman, L. R., et al. (2010)	Intention to seek and accept HIV test	Need to address motivations to test for HIV, in particular HP campaigns, outreach testing and stigma	Location of Test	Stigma
33.	Gotz, H. M., et al. (2014)	Acceptability of online partner notification tool	Valuable tool for PN, suits a small number of patients, particularly those notifying more than one partner	Partner Notification	

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34.	Gotz, H. M., et al. (2005)	Chlamydia screening via home based urine testing	Home based sampling method acceptable along with receiving results by post, access to HCP for positive patients is essential	Sample Collection Method Access to Healthcare Professional	
35.	Graseck, A. S., et al. (2010)	Home v's clinic based screening for STIs	More likely to screen at home than attend clinic for screening	Sample Collection Method	
36.	Graseck, A. S., et al. (2010)	Acceptability of home based screening for STIs	Women more likely to choose to screen at home, and more likely to complete test if choosing home screening than clinic screening	Sample Collection Method	
37.	Gray, D., et al. (2009)	Patient use and preferences for sexual health services in areas with and without one stop services	No significant difference between areas with and without one stop services. Higher percentage of young people citing GP as preferred provider surprising	Location of Test Type of Healthcare Professional	

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
38.	Greacen, T., et al. (2013)	Acceptability of purchasing authorised HIV self-tests online	86.5% expressed interest in being able to purchase online, most commonly cited reasons are convenience, rapidity accessing results, privacy. Those not interested cited satisfaction with current method, doubts over reliability, not wanting to be alone when getting results and fear of getting it wrong	Location of Test Time to Result	Convenience
39.	Greacen, T., et al. (2012)	Access to and use of unauthorised HIV self-tests	Accesing self-test independently associated with living sex life in total secrecy and unprotected anal sex in last 12 months therefore suggesting self-testing may reduce barriers to testing in these groups	Type of Test	
40.	Greenland, K. E., et al. (2011)	Acceptability of internet based chlamydia screening	Participants found the internet and home testing to be positives of the programme. 2% of non-participants cited no internet access as being due to no internet access	Location of Test	

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41.	Gudka, S., et al. (2013)	Chlamydia screening interventions via community pharmacies	Screening in community pharmacies is feasible and can provide an accessible, convenient venue to get a test	Location of Test	Access Convenience
42.	Guenter, D., et al. (2008)	Rapid POC HIV testing programme in a community setting	100% of patients received rapid result compared with 91% of standard test patients. Rapid testing was acceptable to patients and test counsellors, reduced total time and number of visits	Time to result	
43.	Gursahaney, P. R., et al. (2011)	Partner Notification for STIs - practice and preferences	Patient-initiated partner referral methods are more successful among patients with increased self-efficacy and for partners whom patients have stronger relationships. Overall APT not preferred, however women, higher educational attainment and prior STI patients preferred APT	Partner Notification	

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44.	Hambly, S. and G. Luzzi (2006)	Patient preferences for GUM v's GP services	59% patients prefer to attend GUM compared with 30% seeing a GP. However 62% would see GP if it meant being seen more quickly. Most important factors identified were confidentiality, staff attitude, range of tests and specialist knowledge	Location of Service (Test/ Treatment) Type of HCP Range of Tests Knowledge of HCP	Confidentiality Staff Attitude
45.	Hamill, M. and D. Goldmeier (2005)	Genital Herpes Clinic Models	Patients split between preference for GP (42%) follow up and rejecting GP follow up. 62% supportive of nurse led follow up	Type of HCP	
46.	Hawk, M. (2013)	Community based HIV testing and risk reduction intervention	Eighty-seven percent of participants accessed HIV testing with a 100% return rate for results. Study findings suggest that the intervention has potential to be effective in increasing the number of women who access HIV testing.	Location of Test	

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47.	Hengel, B., et al. (2013)	Outreach chlamydia and gonorrhoea outreach	Although outreach reaches a small number of people the yield of infections is high. Settings which appear to be more successful are those within an existing venue rather than a public area	Location of Test	
48.	Hitchings, S., et al. (2009)	What do patients want most from sexual health services?	The results showed that the most highly valued aspects of care were confidentiality (18.47% of points allocated) followed by speed of service (13.1%) and rapid test results (12.12%). These aspects were more important than being seen within 48 hours (7.78%), technical expertise (6.26%) or other patient-centred aspects of care.	Time to Result Knowledge of HCP	Confidentiality Speed of Service
49.	Hoebe, C. J. P. A., et al. (2006)	Acceptability of self-taken vaginal swabs and first catch urine for diagnosing chlamydia and gonorrhoea	Both methods are highly feasible and acceptable and are appropriate specimens for a highly sensitive STI diagnosis	Sample Collection Method	

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50.	Hogan, A. H., et al. (2010)	Young people's attitudes to chlamydia screening in GP practices	Results indicate venue is acceptable however requires normalising e.g. offering chlamydia testing to all attendees within the age range	Location of Test	
51.	Holloway, I. W., et al. (2011)	Men's preferences for STI care testing	Results indicate either clinic or home based sampling is acceptable (71% v's 87%), preference to receiving results via phone, 83% would take medication brought by a partner	Location of Test Results Notification Partner Notification/ Therapy	
52.	Hottes, T. S., et al. (2012)	Internet based HIV and STI testing	Perceived benefits included anonymity, convenience and client centred control. Concerns included reluctance to provide personal information online, need for comprehensive pre-test information and support for people receiving positive results.	Access to Healthcare Professional	Anonymity Convenience Client Centred Control Data Security
53.	Huang, Z. J., et al. (2008)	Self-reported HIV testing behaviours	STI testing rate low due to low perceived risk within the population. No link to traditional access measures	Location of Test	

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54.	Huppert, J. S., et al. (2011)	Acceptability of self-testing for trichomoniasis increases with experience	Four acceptability scales identified: trust of results, confidence, comfort, and effects of testing. Young women lack confidence to self test, undertaking POCT and reviewing results with a clinician increases acceptability	Test Accuracy Access to HCP	Confidence Comfort Effects of Testing
55.	Huppert, J. S., et al. (2012)	Accuracy and trust of self-testing for bacterial vaginosis	Young women can undertake test with reasonable accuracy. Confidence in self-testing increased after experience, and discussion of test results	Sample Collection Method/ Type of Test	
56.	Iles, F. and P. Oakeshott (2005)	Acceptability of being asked to provide a urine sample for chlamydia screening in a GP practice	Males significantly less likely than females to accept the offer of screening. Response rate suggests opportunistic screening in GP practices is acceptable and feasible	Location of Test Sample Collection Method	

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57.	Ingram, J. and D. Salmon (2007)	Young people's experiences of drop in sexual health clinics	highlighted proximity to school/ home, drop in nature, confidentiality professionalism and friendliness of staff	Location of Service/ Test Access to Service e.g. drop in	Confidentiality Professionalism and friendliness of staff
58.	Ingram, J. and D. Salmon (2010)	Young people's views on drop in sexual health services	Drop in services attracted hard to reach groups. Barriers to use included worries about embarrassment, cultural issues and confidentiality.	Type of Service	Embarrassment Cultural issues Confidentiality
59.	Jerome, S., et al. (2009)	Designing sexual health services for young people - methodology for capturing user voice	The priorities were privacy, and a dedicated service close to home, with a drop-in facility and male and female staff being next most important, and an informal service and young staff being lowest priorities. Evidence suggested methodology for capturing views was acceptable	Location of Service/ Test Access to service e.g. drop in	Privacy Gender of staff
60.	Johnson, C. V., et al. (2009)	Access and screening frequency among MSM	Clinicians need to assess sexual risk-taking behaviours and more routinely screen for STIs among sexually active men regardless of disclosure of a history of having sex with men	Location of test	

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
61.	Jones, H. E., et al. (2013)	Preferences for STI services	Preference for self-sampling for testing than an examination. 94% prefer to notify partner directly about STI, 88% would do expedited partner therapy. More likely to prefer 3rd party PN if last partner was a casual partner (14% v's 3%)	Sample Collection Method Partner Notification	
62.	Kerani, R. P., et al. (2013)	Preferences for Patient Delivered Partner Therapy and/or electronic partner notification cards	Men with no symptoms less likely to seek care if notified by an anonymous e-card than if notified directly. 50% reported they would use treatment provided by a partner. Will lead to missed opportunities to test for HIVs and other STIs	Partner Notification	
63.	Knapp, H. and H. D. Anaya (2010)	Provider and patient centred barriers to HIV testing	Confidentiality, offering information, resources, treatment options, and empathetic contact at each step of the process are more likely to encourage patients to consent to HIV testing	Treatment Options	Confidentiality Provision of information Empathetic Contact

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64.	Knussen, C. and P. Flowers (2007)	Acceptability of notification of syphilis results via phone	Phoning in for results significantly more acceptable than phoning home or phoning mobile, phone call to mobile is more acceptable than call to home	Results Notification	
65.	Koester, K. A., et al. (2013)	Sexual healthcare preferences among gay and bisexual men	Identified healthcare into fragmentation (individual services) and consolidation. Drivers for both however overall preference to separate sexual health from other primary care	Type of Service (primary v's sexual health) Location of Service	
66.	Kowalczyk Mullins, T. L., et al. (2010)	Adolescent preferences for HIV testing and impact of rapid tests on results notification	70% preferred rapid to traditional HIV testing and rapid testers more likely to receive results within the follow up period.	Type of Test Results Notification	

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
67.	Krause, J., et al. (2013)	Acceptability of HIV self-testing - systematic review	Review demonstrates HIV self-testing is an acceptable testing alternative and can be performed accurately by individuals. Privacy and Confidentiality valued. Availability of counselling, treatment and care services are major challenges.	Type of Test Sample Collection Method Access to Healthcare Professional	Privacy Confidentiality
68.	Kwan, K. S. H., et al. (2012)	Online Chlamydia Testing	Internet based screening is an effective way to increase access and is valuable alongside clinic based services.	Location of Test	
69.	Lambert, N. L., et al. (2005)	Feasibility, acceptability and effectiveness of community based syphilis screening	Screening in gay venues is acceptable to at risk MSM, reaches a group that doesn't traditionally access services and may be helpful if combined with other STIs (Syphilis diagnosis rate low)	Location of Test	
70.	Langille, D. B., et al. (2008)	Pilot of self-testing for chlamydia screening - characteristics of participants and non-participants	54% cited reason for not using test kit as being asymptomatic, 49% gave low probability of infection as reason for not using test	Type of Test Location of Test	

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71.	Lee, R., et al. (2014)	Incentivising HIV/STI testing	All studies demonstrated higher uptake in incentivised group. Incentives in non-clinical settings were more effective than incentives in clinical settings		Incentivisation of Testing
72.	Leston, J. D., et al. (2012)	Focus groups on STDs, HIV/ AIDS and unplanned pregnancy	Confidentiality and embarrassment concerns impact on young people's decisions to access sexual health services		Confidentiality Embarrassment
73.	Lewis, N. M., et al. (2013)	Rapid POC Testing for HIV	Rapid testing for HIV high acceptable and highly desirable	Type of Test	
74.	Lindberg, C., et al. (2006)	Barriers to sexual and reproductive healthcare	Obtaining sexual health services was a stressful experience with barriers including fear of stigma and loss of social status, shame, embarrassment, privacy/ confidentiality, and accessing and negotiating the healthcare system	Location of Service Access to Service	Stigma Loss of Social Status Shame Embarrassment Privacy Confidentiality

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75.	Ling, S. B., et al. (2010)	Online services for results notification	Results indicate patients accepted online results mainly because of the ability to check results any time of the day	Results Notification	
76.	Llewellyn, C., et al. (2012)	Understanding patient choices for STI testing services	Perceived expertise main reason for attending GUM over GP, other factors included range of tests, lack of expertise, decision on where to test influenced by previous experience, relationship with GP, results notification method and other medical conditions	Location of Service Range of STIs Knowledge of HCP Results Notification	Relationship with HCP
77.	Llewellyn, C., et al. (2009)	Are home sampling kits acceptable to MSM	Home sampling kit generally viewed as positive, concerns about accuracy, delays in results, lack of support were also raised	Sample Collection Method Time to Result Access to HCP Accuracy of Test	
78.	Lorimer, K. and L. McDaid (2013)	Barriers and facilitators to internet based CT screening	Barriers to successful implementation - acceptability, confidentiality and privacy concerns	Location of Test	Acceptability Confidentiality Privacy Concerns

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79.	Lorimer, K., et al. (2009)	Willingness to be tested for CT	Men more willing than women to be tested for CT in non-medical settings	Location of Test	
80.	Marrazzo, J. M., et al. (2007)	Acceptability of urine based screening for CT in asymptomatic men	Asymptomatic men likely to accept testing but it depends on location and approach	Location of Test	
81.	Marrazzo, J. M. and D. Scholes (2008)	Acceptability of urine based screening for CT in asymptomatic men - Systematic Review	Acceptance in non-home based settings is generally higher than home based.	Location of Test	
82.	Marsh, K. A., et al. (2010)	Who chooses rapid HIV testing?	33% of tests taken up were rapid tests, preference higher among MSM following alcohol use but not drugs, and sex workers	Type of Test	
83.	Martin, L., et al. (2013)	Preferred methods for results notification	Preference for texts for negative STI results but lower for negative HIV results. In person preference for positive test results	Results Notification	

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84.	Martin, L., et al. (2013)	Client satisfaction with an 'express STI screening service'	Two most common reasons given for uptake were reduced waiting time and reduced length of consultation. High levels of client satisfaction with 83% stating would use in future	Access to HCP Waiting Time	
85.	Melville, C. R. S., et al. (2004)	Client perspectives of sexual health service provision	Although point of care testing (microscopy) increases time in clinic 99% expressed a preference for this.	Time to Result Type of Test	
86.	Melvin, L., et al. (2009)	Preferred strategies for managing CT infection	Women preferred partner delivered partner medication both for their partners and would prefer it themselves. Men prefer patient referral for partner notification and would prefer it themselves	Partner Notification	
87.	Messer, L., et al (2013)	Barriers and facilitators to testing, treatment entry, and engagement in care by HIV-positive women of colour	Barriers reported by women were aligned with the racial health care disparity model constructs and varied by stage of HIV. Identifying the salient barriers and facilitators at multiple ecological levels along the HIV care continuum may inform intervention development.		
88.	Mills, C., et al (2011)	Barriers to HIV testing among HIV/AIDS concurrently diagnosed persons in New York City	Lack of perception of risk most common reason for not testing for HIV sooner.		Perception of Risk

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89.	Mills, N., et al. (2006)	Experience of CT screening programme	Themes included issues resulting from unease with sexual health issues, anxiety post test result, fear of informing partners, fear of other undiagnosed infections, stigma		Unease with sexual health issues Anxiety post test result Fear of informing partners Fear of other undiagnosed infections Stigma
90.	Mimiaga, M. J., et al. (2008)	Attitudes about internet partner notification for STDs	Broad acceptance of internet as PN method by MSM	Partner Notification	
91.	Miners, A., et al. (2012)	User preferences for different aspects of STI services	People testing have a preference for testing for all infections rather than some and staff with specialist knowledge. Text or call to mobile phone and drop in and wait were preferred methods of results notification	Range of Test Knowledge of HCP Results Notification	

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92.	Mullins, T. K., et al. (2012)	Adolescents agreement to test for HIV when different options are offered	Agreement to test was higher in the following groups: males, parents who completed high school, if test offered by clinician, concerns over infection status	Access to HCP	Concerns over infection status
93.	Napierala Mavedzenge, S., et al. (2013)	Review of self-testing for HIV	Policy shifting with less emphasis now on pre-test counselling. HIV self-testing has been adopted in a number of countries	Type of Test	
94.	Norman, J. E., et al. (2004)	Acceptability of CT screening in ante-natal and gynae clinics	Data on acceptability supports current strategies of screening in abortion clinics	Location of Test	
95.	Novak, D. P. and R. B. Karlsson (2006)	Using the internet and home sampling for CT testing	Study proved internet testing feasible and believed method may encourage more young people to test	Location of test	

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96.	Oliver de Visser, R. and N. O'Neill (2013)	Barriers to STI testing amongst young people	Quantitative data found that desire to comply with other's wishes, perceptions of other's behaviour and shame influenced past testing behaviour. Qualitative data highlight stigma, shame and perceived ease of testing as important		Desire to comply with others wishes Perceptions of other's behaviour Shame Perceived ease of testing
97.	Patel, H., et al. (2007)	Improving sexual health services	Walk in and appointment based models acceptable, most important factor is not being turned away	Access to Service	
98.	Patel, H., et al. (2006)	Results notification preferences	discrepancy between what clients want and what clinics provide with majority of clients wanting to know results regardless of outcomes however 1/5 of clinics only notify positive results	Results Notification	

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99.	Pavlin, N. L., et al. (2006)	Women's views on chlamydia screening - systematic review	Major themes included - need for knowledge and information, choice and support, confidentiality, cost, fear, anxiety and stigma. Women want a range of options and tests should be free, easy and quick		Need for knowledge and information Choice and support Confidentiality Cost Fear Anxiety Stigma Want a range of options to test
100.	Pavlin, N. L., et al. (2008)	Young women's views on implementing chlamydia screening in general practice	Trust in GP was main factor in acceptability, prefer screening based on age rather than sexual risk	Type of HCP	
101.	Peralta, L., et al. (2007)	Barriers and facilitators to adolescent HIV testing	Increased availability of oral and rapid test methods, free testing services, rapid receipt of results would encourage young people to take an HIV test	Type of Test Time to Results	
102.	Perry, C. and M. Thurston (2008)	Model for meeting sexual health needs of young people	Young people can be engaged if service is based on 'best practice'		'Best Practice'

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
103.	Prost, A., et al. (2007)	Taking rapid HIV testing to gay venues	Concerns include confidentiality, privacy, post-test support and clinical standards	Access to HCP	Confidentiality Privacy Clinical Standards
104.	Prost, A., et al. (2009)	Feasibility and acceptability of rapid HIV testing in primary care	Rapid testing in GP practice acceptable but some concerns over post-test support	Location of Test	Post Test Support
105.	Rompalo, A. M., et al. (2013)	POCT for STIs - what do users want?	Home testing POCTs acceptable but concerns over interpreting results, clinic POCT acceptable due to definitive results and immediate treatment. Need to be affordable, rapid, easy to read and simple	Type of Test Accuracy of Result Location of treatment	
106.	Rose, S. B., et al. (2008)	Young people's attitudes to CT screening	Reasons for not testing - fear, stigma, not perceived at risk, don't know how to get tested		Fear Stigma Not perceived at risk Don’t know how to get tested

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
107.	Rosenberger, J. G., et al. (2011)	Self-sampling for ano-rectal STIs among MSM	Results found that it is a feasible and acceptable method of collecting STI samples	Sample Collection Method	
108.	Roth, A., et al. (2011)	Future chlamydia screening preferences	Clinic preferred option followed by home sampling, men prefer results via phone and personalised reminders for future screening	Sample Collection Method Results Notification	
109.	Saadatmand, H. J., et al. (2012)	Young men's preferences for STD and reproductive health services	Preference for using dedicated sexual health service locations rather than 'non-traditional options'. Prefer to receive results from a clinician than online or via text message	Location of Test Results Notification	
110.	Sacks-Davis, R., et al. (2010	Home based chlamydia testing for people attending a music festival	Responses indicated that awareness that chlamydia could make you infertile, more than three partners and inconsistent condom use were the most likely predictors of participants returning screening kits	Type of Test	
111.	Samangaya, M. (2007)	Access to sexual health services for young BME men	Embarrassment was the main factor preventing this group accessing sexual health services		Embarrassment

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
112.	Saunders, J. M., et al. (2012)	Where do young men want to access STI screening?	Willingness to use self-sampling tests was high. Most acceptable collection points were GUM, GP practice and pharmacy	Sample Collection Method Test Collection Location	
113.	Schwandt, M., et al. (2012)	Preferences for rapid point of care testing in primary care	81% would prefer to access rapid testing rather than standard testing	Type of Test Time to Result	
114.	Sena, A. C., et al. (2010)	Feasibility and acceptability of rapid HIV testing - Door to door outreach	People who had not tested for HIV before were more likely to consent, 97% of survey participants supported rapid HIV testing in the community	Location of Test	
115.	Shih, S. L., et al. (2011)	Screening for STIs at home versus clinic	Review of literature found that response rates for home testing up to 11x higher than clinic based testing. Limited evidence with regards cost-effectiveness	Location of Test Sample Collection Method	
116.	Shivasankar, S., et al. (2008)	Views on Patient Delivered Partner Therapy	Traditional partner referral was the preferred option	Partner Notification/ Treatment	

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
117.	Shoveller, J., et al. (2009)	Youth experiences of STI testing in rural communities	Barriers identified include isolating geography means difficult to access service during opening times, privacy, female focussed, fear of disclosing risky sexual behaviour,	Service Opening Times	Privacy
118.	Shoveller, J., et al. (2012)	Youth perspectives on online sexual health services	Online risk assessment and testing services acceptable, particularly in respect of need for convenience, privacy and rapid access. Little tolerance of technology perceived as 'antiquated'	Location of Test	Convenience Privacy Rapid Access
119.	Skala, S. L., et al. (2012)	Factors associated with screening for STIs	Screening completion most commonly associated with college education or higher and home based testing	Location of Test	
120.	Soni, S. and J. A. White (2011)	Self-screening for CT and NG in an HIV clinic	Evaluation indicated that all participants found self-sampling acceptable	Sample Collection Method	
121.	Spielberg, F., et al. (2004)	Self-testing for HIV	Self-testing may be an important additional strategy to aid HIV diagnosis	Type of Test	

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
122.	Sullivan, P. S., et al. (2014)	Safety and acceptability of couples HIV testing for MSM	Couples testing for counselling and HIV is very acceptable to MSM couples	Location of Test	
123.	Tebb, K. P., et al. (2004)	Home STI testing - adolescent female views	Adolescents concerned about having an STI prefer home testing.	Location of Test	
124.	Thomas, F., et al. (2010)	Impact of health service charges on HIV testing in England	Confusion over entitlement to healthcare, financial difficulties and fears over deportation are barriers to accessing sexual health services		Entitlement to healthcare Financial difficulties Fears over deportation
125.	Tomnay, J. E., et al. (2014)	Acceptability of online STI testing	Online testing can address access issues, concerns about privacy, trust, reliability and generalist rather specialist sexual health services were identified as barriers.	Location of Test Type of HCP Knowledge of HCP	Privacy Trust Reliability
126.	Turner, S. D., et al. (2013)	Rapid POCT for HIV in youth	Young people prefer rapid POCT for HIV.	Type of Test Time to Result	
127.	Tuysuzoglu, S., et al. (2011)	Acceptability of rapid HIV testing in an adolescent clinic setting	Most participants valued rapid results.	Time to Result	
128.	Vaughan, D., et al. (2010)	Acceptability and uptake of onsite chlamydia testing	Participation enhanced by anonymity, convenience, accessibility of testing and non-medical approach	Location of Test	Anonymity Convenience Accessibility

	Author	Study Focus	Key Findings	Potential Attributes Identified from Study	Factors Informing Attributes Identified from Study
129.	Watson, V., et al. (2009)	Valuing experience factors in CT screening	Women valued experience factors in the provision of chlamydia screening		Experience factors
130.	Wayal, S., et al. (2011)	Home sampling for STIs - preferences and concerns of MSM	Participants preferred testing kits to be available in medical rather than social venues. Clinic attendance preferred if symptomatic.	Location of Test	
131.	Wayal, S., et al. (2009)	Self-sampling for oral and anal STIs - acceptability	Home sampling acceptable as it was viewed to be less intrusive and more convenient	Sample collection method Location of Test	
132.	Wong, J. P.-H., et al. (2012)	Barriers to STI testing, treatment and care	Fear and social stigma discouraged young heterosexual women from accessing services.		Fear Social Stigma

Appendix 11 – Focus Group – Full Topic Guide Including Vignettes

Introduction

Good evening, my name's Sue, I'm a PhD student at the University of Warwick and I work on a project which is developing new tests and ways to get treated for sexually transmitted infections. Firstly I want to say a huge thank you for giving up your time this evening to talk to me this, your feedback on how to develop sexual health services is really important for my research and hopefully through this will inform how services are developed in the future.

What I'm here to talk to you about is ways of testing and accessing treatment for Sexually Transmitted Infections. When I talk about sexually transmitted infections most of the time I'll probably refer to them as STIs. New technology means that over the next few years there could be more choices available to you for getting tested for STIs and getting treatment. For example point-of-care tests - these are tests where the test is done and you get the result in the same visit e.g. at a clinic or pharmacy. Self-tests are when you can undertake the test and find out the result yourself without needing to attend a clinic, like how a pregnancy test works. For some STIs smartphone apps and e-health clinics are being developed so that if you have a positive test result you can complete an online clinical questionnaire and, if safe, a prescription will be issued so you can go straight to the pharmacy to pick up your treatment.

So tonight is all about what you think, we don't know whether these new ways of testing and accessing treatment are acceptable to people, there might be some things about it you like and others that you don't which would make difference to whether you would choose to use the new test or existing services.

Your participation will help us understand how people want to access services for the testing and treatment of STIs in the future. There are no right or wrong answers, you may all have a different view on it, you may change your mind after you've thought about it or hear what someone else says.

What you'll be doing is listening to some scenarios and answering questions about what you think about them, and then we're going to do a voting exercise – a bit like the x-factor results show, in this case, sending home the things that we like least about services and putting through the things we like most to the final.

It's important to me that you're comfortable saying what you really think, so there are some ground rules for the discussion tonight:

1. What happens in the room stays in the room, please respect the privacy of the other members of the group as they respect yours
2. Respect what other people have to say, even though you may not agree with them all of the time
3. The nature of the topic means that you may find as discussions progress you feel uncomfortable and don't want to continue, if you feel you want to leave at any point please do so. I can assure you that the questions and focus of the group is on the services themselves, I will not be asking any questions about your experiences of sex or using sexual health services
4. As explained in the information leaflet the discussion is being recorded so I don't miss anything you've got to say, but everything will be anonymous and kept confidential. To help me when I listen to the recording back it would be great if you could try and not speak over each other.

Can I just check that you all understand and agree to the ground rules, can we go around the table and each say your name and confirm you understand?

Setting the Scene

So, what I want you to do is imagine that you're on Facebook and an ad you see makes you realise that you want to get an STI check up. . .

Or

You hear from a friend that your ex has been sleeping around and it makes you think about going for an STI check up.

I would like you to keep in mind three scenarios for the next part of the focus group, don't worry about making notes because there's a summary of the key points for you to look at in front of you. To break it up a bit, what I'm going to do, is read out a scenario, see if you've got any questions, and ask what you think before moving onto the next one.

The first two are examples of the sort of thing people have to do at the moment if they want to get tested for an STI and what options are available to you, the final one is a completely new pathway of offering STI care which has never been used before.

The first example is the **Sexual health clinic**
You decide whether you want to make an appointment, either by phone or online, or walk into the sexual health clinic which is one of the local services where you can be tested for STIs. Clinics are normally open during the day in the week and then some evenings and for a few hours on a Saturday. You register with the receptionist on arrival and sit in the waiting room. Whilst you're sat waiting you fill in a number of forms that provide information on who you are, your risks and symptoms. You get called through to see either a nurse or a doctor and they ask you a number of questions including whether you've got any symptoms and details about your health e.g. any medication you take. They will also ask you about whether you've had an STI before and a bit about your recent sex partners.

Depending on whether you report symptoms you may have an examination. For men you'll then have a blood and urine test and/ or swab. For women it will be blood and a vaginal swab. Everyone is tested for chlamydia, gonorrhoea, HIV and syphilis, some people will be tested for other STIs depending on their risk. If you have swabs you'll wait for them to be analysed and get provisional results, normally in about 15-30minutes. If those results indicate an infection they'll give you treatment on the day. You'll be in clinic between 30 minutes and 2 hours.

You'll then leave the clinic and have to wait up to seven days to get your full results. Your results will be texted to you or you may be asked to call a results line to get them. If they're positive and you have not already been treated then the clinic will contact you to arrange a time to return for treatment. When you go back to the clinic you will be seen by a health advisor and a senior nurse or a doctor. The health advisor will talk to you about the infection you've got and telling your partners. You will be encouraged to notify your partners directly yourself but if you don't want to the clinic will do this for you. When you see the senior nurse or doctor they will explain your treatment to you. You'll normally be in clinic for ½ hour to an hour.

Two weeks later a health adviser will call you to make sure there's been no problems with your treatment, and that you have managed to tell your partners.

So, that's the first example, the other thing that I'd like you to think about is what's involved in that example for you – you have to find out where the clinic is and book an appointment, travel to and from the clinic, twice if your results are positive, spend time in the clinic. Although the service is free, there may be cost implications for you e.g. in terms of phone calls, travel costs, having to take time off work.

Are you all still with me?!

Is there anything that you'd like to ask me about what I've told you?

1. Can you think of the things in the example that might make a difference to whether you decided to use this service? What you particularly like or don't like?

   Prompts: How long you have to spend in clinic, having to book an appointment, seeing a healthcare professional, how long you have to wait for your results, the number of times you go to the clinic – to get tested and to get treatment.

The next example is an **Internet Testing Pathway**
You access the local chlamydia screening website and input your details and a test is sent to you at home in the post. The test you are sent will test you for chlamydia and gonorrhoea only. You take your sample yourself – either a urine sample or swab, complete the form that comes with it, choose the way you want your results to be sent to you e.g. text, letter, phone call or email, and send it off in the freepost package it comes with.

Your results will come back within 14 days. If your results are positive you have a number of options to get treatment. Firstly you go back to the screening website and put in your postcode and it brings up the list of the nearest places you can go for treatment. If your result is positive for chlamydia only this will include options like GPs, pharmacies or community sexual health clinics. When you see the health professional you will be asked a series of questions, similar to the ones asked in clinic, and if it is safe to do so you will be given a prescription for treatment, if not you will be referred to a sexual health clinic e.g. if you have symptoms. The health care professional writing the prescription will talk to you about telling your partners.

If your result is positive for gonorrhoea you will need to make an appointment at a community sexual health or GUM clinic to get treatment. You'll see a doctor or nurse who will explain about the infection and the treatment. They will also talk to you about telling your partners.

Whichever route you choose for treatment you'll be followed up by a health advisor two weeks later to make sure there's been no problems with your treatment, and that your partners have been notified.

So, that's the second example, again I'd like you to think about is what's involved in that example for you – you have to order a test online if your results are positive you have to find out how to get treated and travel to the GP, pharmacy or clinic in order to get your treatment. Although the service is free, there may be cost implications for you e.g. in terms of phone calls, travel costs, having to take time off work.

Is there anything that you'd like to ask me about what I've told you?

2. Can you think of the things in the example that might make a difference to whether you decided to use this service? What you particularly like or don't like?

   Prompts: you can do the test yourself, how long you have to wait for your results, the choices to access treatment, being tested for less STIs than at the clinic.

The new service – An internet testing and treatment pathway

You pick up a free test from a supermarket or pharmacy or you can order one online and have it sent to you. The test is like a pregnancy test in that it gives you the results, but it only tests you for the commonest STIs, chlamydia and gonorrhoea.

You choose when and where you want to do the test, for example, in your bathroom at home. The test is done by you taking either taking a vaginal swab or from a urine sample. The test will take around 15mins to get a result. Your smartphone will interpret your test result for you and tell you via an app whether it's positive or negative.

If it's positive for chlamydia then you'll be able to answer some questions within the app or on the website, similar to those asked in clinic. For

example whether you've got any symptoms and details about your health e.g. any medication you take. It will also ask whether you've had an STI before and a bit about your recent sex partners. If it's safe to do so the app will let you choose a pharmacy to collect your treatment from. If the result for gonorrhoea is positive then you'll need to see a doctor or a nurse to get treatment so the app will have a 'find my nearest' function so that you can book an appointment at a sexual health clinic.

If you choose to, you can get a code from the app to text or email to your partners so that they can access the app or website to get more information.

There will be a helpline, staffed by trained health advisors, who you can contact if you've got any problems or concerns, they will help you if the app can't let you choose a pharmacy to get your treatment from. Again, the health advisors will call you two weeks after you get your results to check that there's been no problem with your treatment and to talk to you about telling your partners if you haven't used the app to do this.

So, that's the final example, the other thing that I'd like you to think about is what's involved in that example for you – you have to pick up a test kit whilst you're out and about or order a test online, you have to spend time answering the questions on the app to be able to collect your treatment at any pharmacy. If you're unsure you'll need to call the helpline. Although the service is free, there may be cost implications for you e.g. in terms of phone calls, travel costs, you're less likely to need to take time off work if the app can prescribe because you just need to pop to a pharmacy to pick up the treatment.

3. Can you think of the things in the example that might make a difference to whether you decided to use this service? What you particularly like or don't like?

   Prompts: you can do the test and get the results yourself, how long you have to wait for your results, being able to access treatment via an app/ website if it's safe, being tested for less STIs than at the clinic.

Comparing Examples

In talking about the individual examples you've picked some of the key

things that you may want to make a decision based on. Thinking about all of the examples together now, and there's a summary of the key similarities and differences for you, you can now think about comparing them, there may be one particular thing about an option that makes it more attractive to you than another. For example, how long you have to wait for a test result or whether you have to attend a clinic or GP practice. Or having thought about it, the thing that you think would be important to you in deciding whether to get tested for an STI hasn't been covered in the examples I've just talked you through?

4. Would anyone like to kick off with what they think would be the most important thing to them in making a choice about which service to use to get tested for an STI and why? What I'm going to do is make a note on these cards so that we can use them in the next part of the focus group.

   Prompts: location of testing, location of treatment, length of time to results, having to see a healthcare professional, range of tests, how you get your results, how much time it takes you to get tested and treatment, not being seeing by someone you know

5. Can you think of any other factors about a service that we've not talked about so far that would be important to you in deciding whether you choose to access that service for testing and treatment?

   Prompts: location of testing, location of treatment, length of time to results, having to see a healthcare professional, range of tests, how you get your results, how much time it takes you to get tested and treatment, not being seeing by someone you know

6. There's a few things that other people have identified as being important in making a decision which haven't come out of our discussions, if I shout them out can you tell me whether you think they're important or not and why?

   Prompts: how the sample is collected – urine, swab, blood, whether a new test is more or less accurate than the current test e.g. would you rather have the option to test at home and it was a little less accurate than the test you would have if you went to a clinic, whether you see a healthcare professional if your results are

positive, confidentiality, other options on location of services, we've talked about a little about sexual health clinics, GPs, pharmacies and internet services what about other options e.g. outreach in college, testing in pharmacies.

Prioritisation

So what we're going to do next is rank the different factors we've pulled out, as a group, sort of in the style of an x-factor results show – you will be the judges putting through the ones you definitely want to keep, until we get to the bottom two and we vote one out, until ultimately we've got the winner – what the group thinks is the most important factor in accessing sexual health services. I'm going to keep this moving along just like Dermot does and unfortunately you don't have the opportunity to duck out of making the decision and go with the public vote.

As we've been going along I've written down on the cards the things you've picked out, which one is going to go first?

…

So we have a winner, which is…

Summary

This has been really useful for me, thank you very much for coming along, your comments and suggestions will now be used to develop a survey for a larger group of people to tell me what they think. The plan is that the survey will be online early next year. It is hoped that from this we can get the views of a lot more people on what they think is important in making a decision to test and get treatment for STIs.

Is there anything else that you would like to add before we finish?

Ok, thank you again for your help, if you would like to see a copy of the final report when it's completed please leave your address or email address and I'll send a copy to you.

Appendix 12 – SAS Design Sizes Output (%mktruns)

The SAS System

Design Summary

Number of Levels	Frequency
2	1
4	4
6	1

The SAS System

Saturated = 19
Full Factorial = 3,072

Some Reasonable Design Sizes	Violations	Cannot Be Divided By
48 *	0	
96 *	0	
24	6	16
32	6	6 12 24
64	6	6 12 24
72	6	16
80	6	6 12 24
40	12	6 12 16 24
56	12	6 12 16 24
88	12	6 12 16 24
19 S	21	2 4 6 8 12 16 24

* - 100% Efficient design can be made with the MktEx macro.
S - Saturated Design - The smallest design that can be made.
Note that the saturated design is not one of the
recommended designs for this problem. It is shown
to provide some context for the recommended sizes.

Appendix 13 – Cognitive Testing Interview Schedule

Participant No:

Date:

Start Time:

Finish Time:

Introduction
Overview of interview
Check happy to proceed

Section 1 – Background

Can you tell me what the background section is telling you in your own words?

Are there any terms used which you are unsure of their meaning?

Section 2 – About the Questionnaire

Can you tell me what you need to do to complete the questionnaire?

Can you explain what the diagram is showing you?

What do you understand by the term ‘self test’?

What do you understand by the term ‘provide a sample’?

What do you understand by the term ‘interpret the result yourself’?

What do you understand by the term ‘healthcare professional’?

What do you understand by the term ‘test accuracy’ in this survey?

Can you explain to me what you understand by '2 in 100 people will be told that their test result is negative when they do have Chlamydia?
Preference for Picture v's Words

Can you explain what the diagram is telling you?

What do you understand by the term 'How you get your treatment'?

Can you explain to me what the 'How you contact a healthcare professional section' is telling you in your own words?

Can you explain to me what the 'How you get your antibiotics section' is telling you in your own words?

Part 3 – Demographics

Can you explain to me what you are being asked to provide in the demographics section? (Probe individual questions as necessary). Probe Relationship Status

Part 4 – DCE Choices
What I would like you to do now is complete the questionnaire in its entirety. I am going to time this section to see how long it takes. At the end of the questionnaire I will ask you how you made each choice you made e.g. what you were thinking, the reasons for making the choice.

Time:

DCE Choices

Choice 1 –

Choice 2 –

Choice 3 –

Choice 4 –

Choice 5 –

Choice 6 –

Choice 7 –

Choice 8 –

Choice 9 –

Choice 10 –

Choice 11 –

Choice 12 –

Choice 13 –

Choice 14 –

Choice 15 –

Choice 16 –

Choice 17 –

Choice 18 –

Choice 19 –

Choice 20 –

Choice 21 –

Choice 22 –

Choice 23 –

Choice 24 –

Choice 25 –

How sure did you feel of your answers?

Is it difficult to answer the choice questions?

Is there anything else that you would like to tell me about the questionnaire that you think will help improve its design?

Close
Thank for time
Sign off sheet for voucher

Copy of Final Research – Yes/ No

Appendix 14 – Sample Screenshots from DCE Questionnaire

Support | Privacy | Quit

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Developing Chlamydia Testing & Treatment Services

This survey is designed to find out more about your views on what is important to you in accessing services to get tested for chlamydia, and treatment if your test result is positive (i.e. you have chlamydia). This forms part of a research project being undertaken at the University of Warwick, please click here to access further information about the study and how your information will be used. By continuing to complete the survey you are consenting for your responses to be used for research in accordance with the information set out in the study information leaflet. Your responses will help us understand what is important to young people to shape how services are developed in the future.

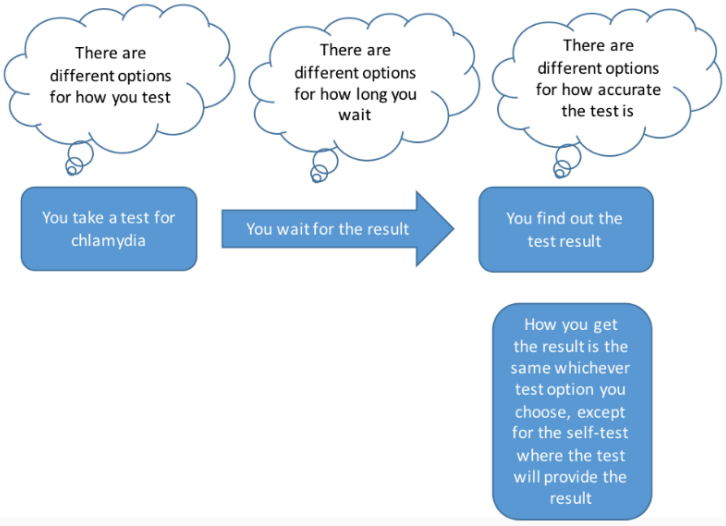
Please read through the following background information before completing the survey. It contains information about chlamydia and the terms that are used in the survey.

What is Chlamydia?
Chlamydia is the most common sexually transmitted infection in England and the majority of infections are found in young people aged 15-24. Both men and women can get chlamydia, but most people with chlamydia have no symptoms and do not know they have an infection. The test for chlamydia is usually a urine sample for men and a vaginal swab for women. Once diagnosed, chlamydia can be treated with a single dose (2 or 4 tablets) of an antibiotic called Azithromycin.

In England there is a national chlamydia screening programme which recommends that people aged 16-24 are tested for chlamydia annually or when they change their sexual partner.

The following sections provide you with an explanation of the process of getting tested and treatment and the key terms used in the survey:

The diagram below shows the stages up until you find out our result:



The following sections provide more information on how you test, how long you wait for the result and the accuracy of the test.

How you test for Chlamydia
This focuses on how you get your test, how the sample is taken and what happens to the sample once you've taken it. There are six options in the questionnaire, an explanation of these is provided below:

- **Self-Test** - Order a test kit online or collect one from a community location e.g. pharmacy or supermarket, provide the sample yourself and interpret the result yourself (like a pregnancy test). This is different to the self-sample options below because you interpret the result yourself rather than it being interpreted by a healthcare professional.
- **Self-Sample and post off for analysis** - Order a test kit online or collect one from a community location e.g. pharmacy or supermarket, provide the sample yourself and send the sample in the freepost envelope to the laboratory for analysis. This is different to the self-test option above because the test is interpreted by a healthcare professional.
- **Self-Sample and take to pharmacy for analysis** - Order a test kit online or collect one from a community location e.g. pharmacy or supermarket, provide the sample yourself and then take the sample to a pharmacy for analysis. This is different to the self-test option above because the test is interpreted by a healthcare professional. Opening hours vary between pharmacies but many in towns and cities are open evenings and weekends as well as weekdays.
- **Self-Sample and take to your place of education/ workplace for analysis** - Order a test kit online or collect one from a community location e.g. pharmacy or supermarket, provide the sample yourself and take the sample to your place of education/ workplace for analysis by an outreach nurse. This is different to the self-test option above because the test is interpreted by a healthcare professional. Outreach services in education and workplaces are usually available one day a week.
- **Attend GP Practice, sample taken by a GP or Nurse** - Book an appointment at your GP practice with a GP or practice nurse. Your sample will be taken by the healthcare professional you see. GP practices are routinely open Monday to Friday 8am - 6.30pm.
- **Attend sexual health clinic, sample taken by a Doctor or Nurse** - Drop in or book an appointment with a doctor or nurse at a sexual health clinic. Your sample will be taken by the health care professional you see. Sexual Health Clinics are located in towns and cities, opening hours vary but clinics are generally open during the working day Monday to Friday, some evenings during the week and Saturdays.

Taking a sample yourself is straightforward and does not affect the accuracy of the test result.

Back Next

How you get your antibiotics
Once you've completed your consultation you need to get your antibiotic tablets. In this survey there are four options available to you:

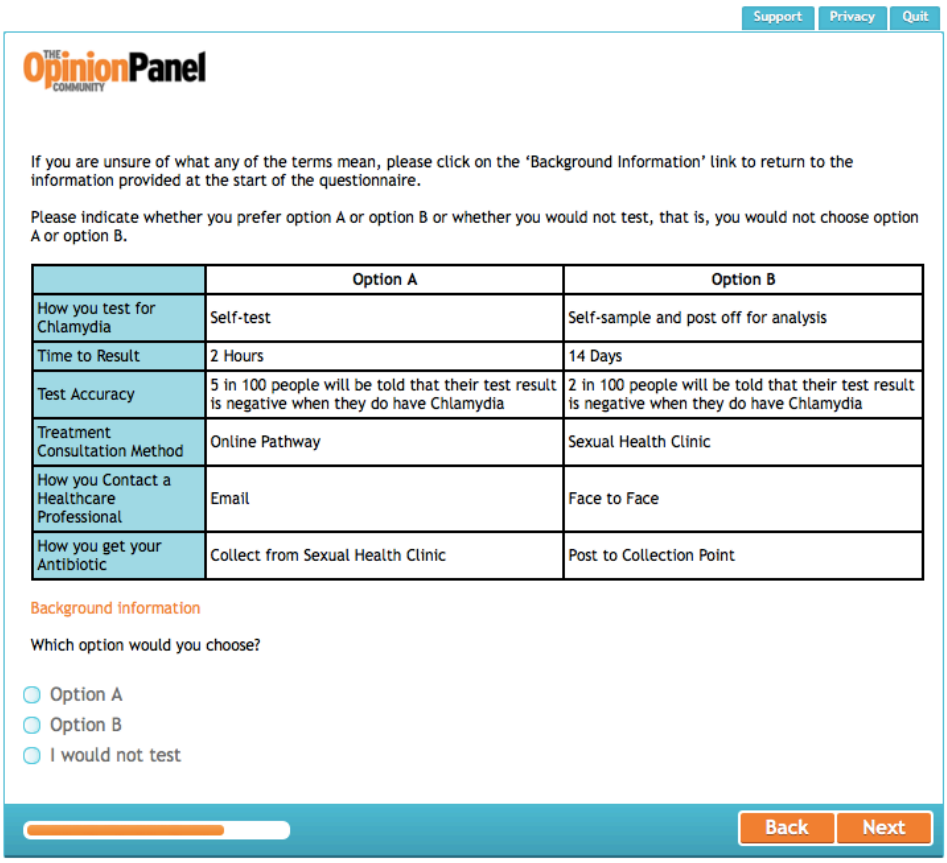
- Deliver to home address - provide your home address for your antibiotic to be posted to you. Your antibiotic will arrive within 1-2 working days.
- Deliver to collection point - nominate an address other than your home address, for example a friend's address or a collection point for your antibiotic to be posted to. Your antibiotic will arrive within 1-2 working days.
- Collect from Pharmacy - attend a pharmacy of your choice with your prescription and the pharmacist gives you the antibiotic tablets
- Collect from Sexual Health Clinic - attend a sexual health clinic and the doctor or nurse gives you the antibiotic tablets

In all of the choices available to you there are a number of things that you should assume are the same:

- The service is provided to you free of charge although there may be a cost to you, for example in making phone calls, accessing the internet, or taking time off work to go to an appointment.
- The healthcare professional who is providing your treatment is trained to be able to provide the service.
- How you get your results is the same whichever option you choose, except for the self-test where the test will provide the result.
- Your personal data is managed securely in whichever option you choose

More choices for an option does not mean that it is more or less important, it just reflects that there are more choices within the scenarios you are being asked to consider.

Back Next



Support Privacy Quit

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If you are unsure of what any of the terms mean, please click on the 'Background Information' link to return to the information provided at the start of the questionnaire.

Please indicate whether you prefer option A or option B or whether you would not test, that is, you would not choose option A or option B.

	Option A	Option B
How you test for Chlamydia	Self-test	Self-sample and post off for analysis
Time to Result	2 Hours	14 Days
Test Accuracy	5 in 100 people will be told that their test result is negative when they do have Chlamydia	2 in 100 people will be told that their test result is negative when they do have Chlamydia
Treatment Consultation Method	Online Pathway	Sexual Health Clinic
How you Contact a Healthcare Professional	Email	Face to Face
How you get your Antibiotic	Collect from Sexual Health Clinic	Post to Collection Point

Background information

Which option would you choose?

- Option A
- Option B
- I would not test

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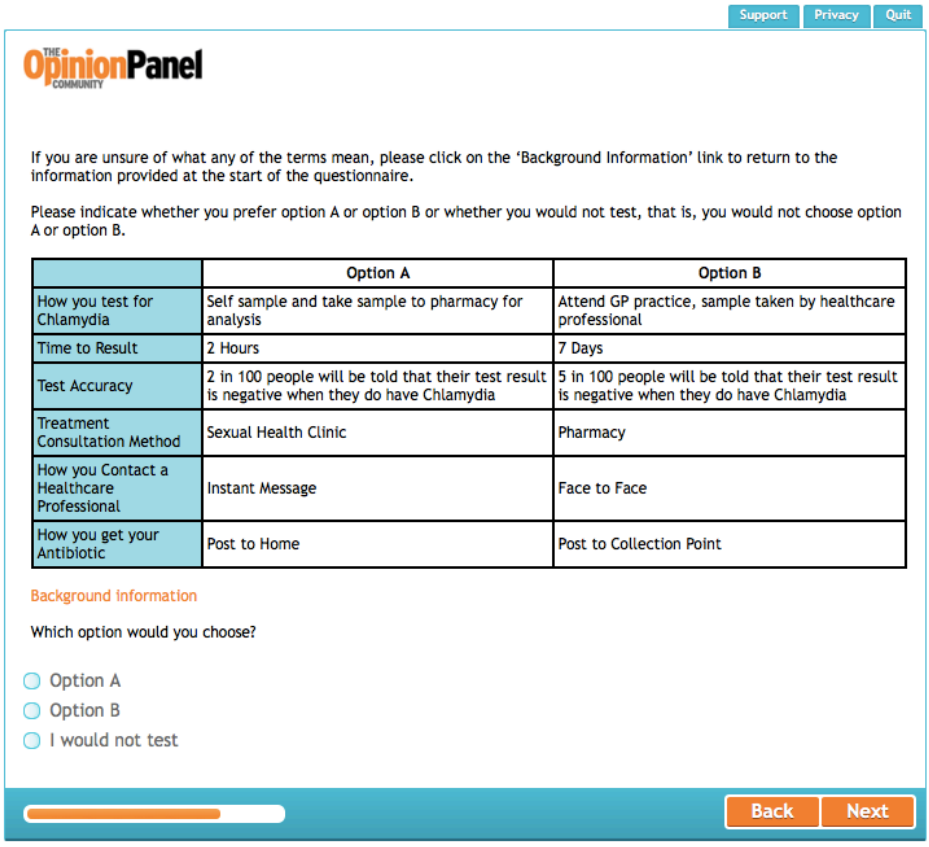

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If you are unsure of what any of the terms mean, please click on the 'Background Information' link to return to the information provided at the start of the questionnaire.

Please indicate whether you prefer option A or option B or whether you would not test, that is, you would not choose option A or option B.

	Option A	Option B
How you test for Chlamydia	Self sample and take sample to pharmacy for analysis	Attend GP practice, sample taken by healthcare professional
Time to Result	2 Hours	7 Days
Test Accuracy	2 in 100 people will be told that their test result is negative when they do have Chlamydia	5 in 100 people will be told that their test result is negative when they do have Chlamydia
Treatment Consultation Method	Sexual Health Clinic	Pharmacy
How you Contact a Healthcare Professional	Instant Message	Face to Face
How you get your Antibiotic	Post to Home	Post to Collection Point

Background information

Which option would you choose?

- Option A
- Option B
- I would not test

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Appendix 15 – Costing Study Interview Topic Guide – Provider

1. **Introduction and Informed Consent**
   - Explain purpose of interview and duration
   - Confirm consent with signature of consent form
   - Answer any questions from participant

2. **Pathway Element – to be repeated for each required pathway element**
   a. I understand that you are a provider of [insert details] and I'd like to understand more about the costs of the pathway. I appreciate that you may or may not have costs for the component elements. *Prompts: (dependent on provider type). Do you have service line reporting or patient level costing systems in place? Are you able to tell me about [insert element] do you have a cost for this? Do you have details of the resource inputs for [insert element]? Who within the service would be able to provide me with more information on?*
   b. Do you sub-contract any part of the [insert pathway element]? *If so, to whom, do you have a unit price for this? Could you provide me with the contact details of someone at the sub-contractor I could discuss this further with?*

3. **Close Interview**
   - Any final questions from participant
   - Clarify position regarding organisational anonymity
   - Thank participant for time/ contribution

Appendix 16 – Medline Search – Costs and Cost-Effectiveness

#	Searches	Results
1	"cost effective*".mp.	72679
2	"cost benefit".mp. or exp Cost-Benefit Analysis/	64741
3	"cost utility*".mp.	2367
4	"cost minimi*".mp.	861
5	"cost consequence".mp.	112
6	(CEA or CBA or CMA or CUA or CCA).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	48258
7	"economic analys*".mp.	2826
8	"economic evaluation".mp.	4937
9	"economic model*".mp. or exp Models, Economic/	11324
10	"cost analys*".mp. or exp "Costs and Cost Analysis"/	185476
11	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10	282194
12	exp Chlamydia/ or exp Chlamydia trachomatis/	12737
13	11 and 12	352
14	limit 13 to (english language and humans and yr="2005 - 2014")	117

Appendix 17 – Medline Search – Consequences

#	Searches	Results
1	exp Chlamydia/ or exp Chlamydia trachomatis/	13674
2	exp Genital Diseases, Male/ or exp Genital Diseases, Female/	629036
3	1 and 2	9889
4	exp Time-to-Treatment/	2211
5	"loss to follow*".mp.	2209
6	"appropriate clinical management".mp.	296
7	exp Treatment Outcome/	788680
8	diagnosis to treatment.mp.	372
9	exp Contact Tracing/	3650
10	4 or 5 or 6 or 7 or 8 or 9	795965
11	3 and 10	335
12	limit 11 to (english language and humans)	296